ISSN 1188-4169

Canada Communicable Disease Report

Date of Publication: July 1999

Volume 25S4

Supplement

infection control guidelines

Routine Practices and Additional Precautions for Preventing the Transmission of Infection in Health Care

Health Canada Santé Canada

Canada

101-03138/

INFECTION CONTROL GUIDELINES

Routine Practices and Additional Precautions for Preventing the Transmission of Infection in Health Care

Revision of Isolation and Precaution Techniques

Health Canada
Laboratory Centre for Disease Control
Bureau of Infectious Diseases
Division of Nosocomial and Occupational Infections

Introductory Statement

The primary objective in developing clinical guidelines at the national level is to help health care professionals improve the quality of health care. Guidelines for the control of infection are needed to assist in developing policies, procedures and evaluative mechanisms to ensure an optimal level of care. Guidelines, by definition, are directing principles and indications or outlines of policy or conduct, which should not be regarded as rigid standards. Guidelines facilitate the setting of standards but respect the autonomy of each institution and recognize the governing body's authority and responsibility of ensuring the quality of resident care provided by the institution.

The guidelines, whenever possible, have been based on research findings. There are some aspects about which there is insufficient published research, and consensus of experts in the field has therefore been used to provide guidelines specific to conventional practice.

The information in these guidelines was current at the time of publication; it should be emphasized that areas of knowledge and aspects of medical technology advance with time. Both encouragement of research and frequent revision and updating to keep pace with advances in the field are necessary if guidelines are to achieve the purpose for which they have been developed.

The Steering Committee acknowledges, with sincere appreciation, the many practising health professionals and others who contributed advice and information to this endeavour. Health Canada is especially appreciative of the time and expertise contributed by the Subcommittee, which worked diligently and successfully to develop these extensive guidelines: Dr. Dorothy Moore (Chair), Karen Green, Dr. B. Lynn Johnston, Linda Kingsbury, Catherine Mindorff, Deborah Norton, Laurie O'Neil, Shirley Paton, Diane Phippen, and Yolaine Rioux.

The guidelines outlined herein are part of a series that has been developed over a period of years under the guidance of the Steering Committee on Infection Control Guidelines. *Infection Control Guidelines: Routine Practices and Additional Precautions for Preventing the Transmission of Infection in Health Care* (revision of *Infection Control Guidelines Isolation and Precaution Techniques)* presents the principles necessary to prevent the transmission of microorganisms from patient to patient across the continuum of care. Transmission principles, routine practices and additional precautions are outlined for acute care, long term care, ambulatory care and home care settings.

This document is part of the Health Canada series of *Infection Control Guidelines* and is intended to be used with the other *Infection Control Guidelines*. Others in the series include the following:

Hand Washing, Cleaning, Disinfection and Sterilization in Health Care [Revision of *Part V - Hospital Environmental Control*], (December, 1998)

Preventing the Spread of Vancomycin-Resistant Enterococci (VRE) in Canada (1997)

Preventing Infections Associated with Foot Care by Health Care Providers (1997)

Preventing Infections Associated with Indwelling Intravascular Access Devices (1997)

Preventing the Transmission of Bloodborne Pathogens in Health Care and Public Services Settings (1997)

Preventing the Transmission of Tuberculosis in Canadian Health Care Facilities and Other Institutional Settings (1996)

Long Term Care Facilities (1994)

Canadian Contingency Plan for Viral Hemorrhagic Fevers and Other Related Diseases (1997)

Occupational Health in Health Care Facilities (1990) (Under revision)

Prevention of Nosocomial Pneumonia (1990) (Under revision)

Antimicrobial Utilization in Health Care Facilities (1990)

Prevention of Surgical Wound Infections (1990)

Prevention of Urinary Tract Infections (1990)

Perinatal Care (1988)

Organization of Infection Control Programs in Health Care Facilities (1990)

For information regarding the above Health Canada publications, contact:

Division of Nosocomial and Occupational Infections
Bureau of Infectious Diseases
Laboratory Centre for Disease Control
Health Canada, PL 0603E1
Ottawa, Ontario K1A 0L2
Tel.: (613) 952-9875
Fax: (613) 998-6413

Steering Committee on Infection Control Guidelines

Dr. Lindsay Nicolle **(Chair)**
H.E. Sellers Professor and Chair
Department of Internal Medicine
University of Manitoba Health Sciences Centre
GC 430, 820 Sherbrooke Street
Winnipeg, Manitoba
R3A 1R9
Tel.: (204) 787-7772
Fax: (204) 787-4826
e-mail: lnicolle@hsc.mb.ca

Dr. John Conly
Hospital Epidemiologist and
Associate Professor of Medicine
The Toronto Hospital, Room 117A-NU13
200 Elizabeth Street
Toronto, Ontario
M5G 2C4
Tel.: (416) 340-4858
Fax: (416) 340-5047
e-mail: jconly@torhosp.toronto.on.ca

Dr. Charles Frenette
Hospital Epidemiologist and
Associate Professor of Medicine
Infectious Diseases
Hôpital Charles Lemoyne
Sherbrooke University
121 Taschereau Blvd.
Greenfield Park, Qc
J4V 2H1
Tel.: (514) 466-5000 locale 2834
Fax: (514) 466-5778
e-mail: charles.frenette@rrsss16.gouv.ca

Colleen Hawes
Simon Fraser Health Region
330 E Columbia Street
New Westminster, BC
V3L 3W7
Tel: (604) 520-4730
Fax: (604) 520-4724
e-mail: Colleen_Hawes@sfhr.hnet.bc.ca

Agnes Honish
Manager, Communicable Disease Control
Capital Health Authority
Community and Public Health
Suite 300, 10216 - 124th Street
Edmonton, Alberta
T5N 4A3
Tel.: (403) 413-7944
Fax: (403) 413-7950
e-mail: ahonish@cha.ab.ca

Dr. B. Lynn Johnston
Hospital Epidemiologist and
Associate Professor of Medicine
Queen Elizabeth II Health Sciences Centre
Room 5-014 ACC
1278 Tower Road
Halifax, N.S.
B3H 2Y9
Tel.: (902) 428-7003
Fax: (902) 473-7394
e-mail: ljohnsto@is.dal.ca

Linda Kingsbury
Nurse Consultant
Division of Nosocomial and Occupational Infections
Bureau of Infectious Diseases
Laboratory Centre for Disease Control, 0603E1
Health Canada
Ottawa, Ontario K1A 0L2
Tel.: (613) 957-0328
Fax: (613) 998-6413
e-mail: Linda_Kingsbury@hc-sc.gc.ca

Catherine Mindorff
Community & Institutional Infection Prevention and Control
202 Yahara Place
Ancaster, Ontario
L9G 1Y5
Tel: (905) 304-1196
Fax: (905) 304-1999

Dr. Dorothy Moore
Associate Professor of Pediatrics
McGill University
Division of Infectious Diseases
Montréal Children's Hospital
2300 Tupper
Montréal, Québec
H3H 1P3
Tel.: (514) 934-4485
Fax: (514) 934-4494
e-mail: dmooinf@mch.mcgill.ca

Deborah Norton
Infection Control Practitioner
Regina General Hospital
1440 - 14th Avenue
Regina, Saskatchewan
S4P 0W5
Tel: (306) 766-4675 (office)
(306) 766-4444 (Switchboard - Pager #6556)
Fax: (306) 766-4640

Laurie O'Neil
Infection Prevention and Control Consultant
4908 Nelson Rd. N.W.
Calgary, Alberta
T2K 2L9
Tel.: (403) 282-2340
e-mail: laurieoneil@home.com

Shirley Paton
Chief, Division of Nosocomial and Occupational Infections
Bureau of Infectious Diseases
Laboratory Centre for Disease Control, 0603E1
Health Canada
Ottawa, Ontario K1A 0L2
Tel.: (613) 957-0326
Fax: (613) 998-6413
e-mail: Shirley_Paton@hc-sc.gc.ca

Diane Phippen
Epidemiologist Nurse Coordinator
Cadham Provincial Laboratory
Box 8450, 750 William Avenue
Winnipeg, Manitoba
R3C 3Y1
Tel.: (204) 945-6685
Fax: (204) 786-4770

Dr. Geoffrey Taylor
Department of Medicine
Division of Infectious Diseases
The University of Alberta
2E4.11 Walter Mackenzie Centre
Edmonton, Alberta
T6G 2B7
Tel.: (780) 407-7786
Fax: (780) 407-7137
e-mail: geoff.taylor@ualberta.ca

Dr. Dick Zoutman
Medical Director
Infection Control Service
Kingston General Hospital
76 Stuart Street
Kingston, Ontario
K7L 2V7
Tel: (613) 549-6666 ext 4015
Fax: (613) 548-2513
e-mail: zoutman@cliff.path.queensu.ca

Liaison Representatives

Association des médecins microbiologistes infectiologues du Québec (AMMIQ)

Dr. Charles Frenette
Dr. Pierre St. Antoine

Association des professionnels pour la prévention des infections (APPI)

Monique Delorme
Yolaine Rioux

Canadian Association for Clinical Microbiology and Infectious Diseases (CACMID)

Dr. Mary Vearncombe

Canadian Council on Health Services Accreditation

Marilyn Colton

Canadian Healthcare Association

Barbara Lyons
Rosa Paliotti

Canadian Infectious Disease Society (CIDS)

Dr. John Conly
Dr. Gary Garber
Dr. Lynn Johnston

Community and Hospital Infection Control Association (CHICA - Canada)

Susan MacMillan
Deborah Norton

Ex-officio Member

Dr. John Spika
Director, Bureau of Infectious Diseases
Laboratory Centre for Disease Control, 0603E1
Health Canada
Ottawa, Ontario
K1A 0L2
Tel.: (613) 957-4243
Fax: (613) 998-6413

Subcommittee for Revision of Isolation And Precaution Techniques

Dr. Dorothy Moore (**Chair**)
Associate Professor of Pediatrics
McGill University
Division of Infectious Diseases
Montréal Children's Hospital
2300 Tupper
Montréal, Québec
H3H 1P3
Tel: (514) 934-4485
Fax: (514) 934-4494
e-mail: dmooinf@mch.mcgill.ca

Karen Green
Epidemiologist, Clinical Research
Mount Sinai Hospital
Rm. 1460, Dept. of Microbiology
600 University Ave.
Toronto, Ontario
M5G 1X5
Tel: (416) 586-5105
Fax: (416) 586-3140
e-mail: Kgreen@mtsinai.on.ca

Dr. B. Lynn Johnston
Hospital Epidemiologist and
Associate Professor of Medicine
Queen Elizabeth II Health Sciences Centre
Room 5 - 014 ACC
1278 Tower Road
Halifax, Nova Scotia
B3H 2Y9
Tel: (902) 473-7003
Fax: (902) 473-7394
e-mail: ljohnsto@is.dal.ca

Linda Kingsbury
Nurse Consultant
Division of Nosocomial and Occupational
Infections
Laboratory Centre for Disease Control
Health Canada
Tunney's Pasture, PL 0603E1
Ottawa, Ontario
K1A 0L2
Tel: (613) 957-0328
Fax: (613) 998-6413
e-mail: Linda_Kingsbury@hc-sc.gc.ca

Catherine Mindorff
Community and Institutional Infection
Prevention and Control
202 Yahara Place
Ancaster, Ontario
L9G 1Y5
Tel: (905) 304-1196
(905) 527-4322 ext 2056
Fax: (905) 304-1999
e-mail: mindorff@fhs.scu.mcmaster.ca

Deborah Norton
Infection Control Practitioner
Regina General Hospital
1440 - 14th Avenue
Regina, Saskatchewan
S4P 0W5
Tel: (306) 766-4675 (office)
(306) 766-4444 (Switchboard -
Pager #6556)
Fax: (306) 766-4640

Laurie O'Neil
Infection Prevention and Control Consultant
4908 Nelson Rd. N.W.
Calgary, Alberta
T2K 2L9
Tel: (403) 282-2340
e-mail: laurieoneil@home.com

Shirley Paton
Chief, Division of Nosocomial and
Occupational Infections
Laboratory Centre for Disease Control
Health Canada
PL 0603E1
Ottawa, Ontario
K1A 0L2
Tel: (613) 957-0326
Fax: (613) 998-6413
e-mail: Shirley_Paton@hc-sc.gc.ca

Diane Phippen
Epidemiologist Nurse Coordinator
Cadham Provincial Laboratory
Box 8450, 750 William Avenue
Winnipeg, Manitoba
R3C 3Y1
Tel: (204) 945-6685
Fax: (204) 786-4770

Yolaine Rioux
Agent de planification et de programmation
Module maladies transmissibles
Direction de la santé publique, de la
planification et de l'évaluation de la
Montérégie
5245 boul Cousineau, bureau 3000
Saint-Hubert (Québec)
J3Y 6J8
Tél: (450) 928-6777 ext 5481
Télec: (450) 928-6781
Courriel: y.rioux@rrsss16.gouv.qc.ca

Table of Contents

PART A. OVERVIEW OF ISOLATION PRECAUTIONS

I. Introduction 1

A. Evolution of isolation precautions 1
B. History of Canada's isolation guidelines 3
C. Changing patient populations and health care delivery systems 3
D. Changing nosocomial infections 4
E. Risk-benefit of prevention of transmission 4
F. Isolation precautions used in Canada and the need for change 5
G. Principles on which this document is based 5

II. Principles of Transmission of Microorganisms 7

A. Contact transmission 7
1. Direct and Indirect Contact 7
2. Droplet Transmission 8
B. Airborne transmission 9
C. Common vehicle transmission 9
D. Vectorborne transmission 10
Figure 1: How Microorganisms Are Acquired 11

III. Antimicrobial Resistant Organisms (ARO) 12

A. Antimicrobial resistant organisms (ARO) in acute care facilities 12
1. Transmission of ARO 12
2. Control of ARO in Acute Care Facilities 13
B. ARO in other health care settings 14

IV. Assessment of Risk 16

A. Risk factors for transmission, colonization, and disease 16

1. Transmission. 16
2. Colonization 16
3. Disease 17

B. Role of the inanimate environment 17

C. Assessing risk of transmission 18

Table 1. Risk Factors for Transmission and Disease After Exposure to Infected or Colonized Source Patient 19

D. Transmission in non-acute care settings 20

1. In Long Term Care. 20
2. In Ambulatory Care 20
3. In Home Care 21

E. Balancing the impact of transmission and the impact of prevention strategies 21

Table 2. Impact of Transmission and Impact of Prevention Strategies 22

V. Patient Care Practices To Prevent Transmission 23

A. Hand washing 23

B. Gloves 24

C. Gowns 26

D. Masks, eye protection 27

E. Accommodation 27

PART B. RECOMMENDATIONS AND TOOLS

I. Recommendations for Acute Care Facilities 33

A. Routine practices for acute care facilities 33
1. Hand Washing/Hand Antisepsis 33
2. Gloves 35
3. Mask, Eye Protection, Face Shield 35
4. Gowns 36
5. Accommodation 36
6. Patient Care Equipment 36
7. Environmental Control 37

B. Additional precautions for acute care facilities 37
1. Airborne Transmission Precautions 38
Table 3. Airborne Transmission Precautions 39
2. Droplet Transmission Precautions 41
Table 4. Droplet Transmission Precautions 42
3. Contact Transmission Precautions 45
Table 5. Contact Transmission Precautions 46
4. Antimicrobial Resistant Organisms (ARO): Special Considerations 50

II. Recommendations for Long Term Care Facilities 52

A. Routine practices for long term care facilities 52
1. Hand Washing/Hand Antisepsis 52
2. Gloves 53
3. Mask, Eye Protection, Face Shield 54
4. Gowns 54
5. Personal Care Supplies 54
6. Health Care Equipment 54
7. Environmental Control 55

B. Additional precautions for long term care facilities 55
1. Airborne Transmission Precautions 56
2. Droplet Transmission Precautions 58
3. Contact Transmission Precautions 59
4. Care of Residents with Antimicrobial Resistant Organisms (ARO) 60

III. Recommendations for Ambulatory Care 63

A. Routine practices for ambulatory care 63
1. Hand Washing/Hand Antisepsis 63
2. Gloves 64
3. Mask, Eye Protection, Face Shield 65
4. Gowns 65
5. Equipment and Environment 65

B. Additional precautions for ambulatory care 66
1. Airborne Transmission Precautions 66
2. Droplet Transmission Precautions 67
3. Contact Transmission Precautions and Precautions for ARO. . . 67

IV. Recommendations for Home Care 69

A. Routine practices for home care 69
1. Hand Washing/Hand Antisepsis 69
2. Gloves 70
3. Mask, Eye Protection, Face Shield 71
4. Gowns/Aprons 71
5. Equipment and Environment 71

B. Additional precautions for home care 72
1. Airborne Transmission Precautions 72
2. Droplet Transmission Precautions 73
3. Contact Transmission Precautions 73
4. Care of Clients with Antimicrobial Resistant Organisms (ARO). . 74

V. Responsibility for Initiation of Additional Precautions 76

VI. Tools for Implementation of Precautions 78

A. Establishing priorities for single rooms 78

B. Examples of cards for additional precautions. 79

C. Transmission summary tables 83

Table 6. Transmission Characteristics and Empiric Precautions by Clinical Presentation: Recommendations for acute care centres 84

Table 7. Transmission Characteristics and Precautions by Specific Etiology: Recommendations for acute care centres 90

References 113

Appendix I – Guideline Rating System 135

Table 8. Strength and Quality of Evidence for Recommendations 136

Appendix II – Glossary of Terms 137

Appendix III – Techniques 140

PART A.

OVERVIEW OF ISOLATION PRECAUTIONS

I. Introduction

A. Evolution of isolation precautions

Isolation precautions have evolved from the concept of "fever hospitals" for the care of patients with specific communicable pathogens of major public health concern, such as smallpox, diphtheria, and tuberculosis[1]. As these diseases became less prevalent, care was transferred to special isolation wards in general hospitals and eventually to single rooms on regular patient care wards. Over time, isolation precautions were extended to all patients with infections considered to be transmissible. Infectious diseases were classified according to the presumed major mechanism of transmission, and specific precautions were recommended for each transmission category[2]. A pre-printed card listed the precautions to be taken for each selected category. Category-based precautions were simple to learn and implement. However, dissatisfaction with category-based guidelines developed. Mechanisms of disease transmission did not always fit into the assigned categories, resulting in excessive or inadequate use of barrier techniques. Health care workers (HCWs) wanted to have more flexibility in applying isolation precautions[3,4].

As a result, an alternative disease-specific system was developed whereby isolation precautions were fine-tuned according to the requirements for the individual patient. Hospitals could choose between category- or disease-specific systems[3]. Specific barrier techniques (single room, air control, gloves, gowns, masks) were assigned according to the patient's diagnosis or symptoms or the microbe isolated, as well as to patient behavioural characteristics (age, mental status, mobility, continence). Isolation precautions were written or selected from check boxes on an isolation card. Disease-specific precautions eliminated unnecessary measures, permitting more efficient use of facilities and materials. Compliance was expected to be higher since these recommendations were more epidemiologically sound. There was an increased emphasis on decision making on the part of the HCW. However, there were a number of drawbacks. This system required more knowledge, initiative and responsibility on the part of HCWs. Selecting the appropriate techniques for individual patients was time consuming. There was a risk of error when HCWs were not adequately informed, when the diagnosis was incorrect, or when personnel were rushed[5,6].

The most dramatic modification in isolation precautions occurred following the realization that the bloodborne pathogen human immunodeficiency virus (HIV) could be transmitted from patients with unrecognized infection to HCWs[7]. Initiation of bloodborne pathogen precautions based on symptoms or diagnosis was no longer adequate. The response to this problem was the extension of the use of blood and body fluid precautions to all patients. These precautions became known as Universal Precautions (UP). UP included use of barrier precautions such as

gloves for contact with blood and certain other body fluids; gowns, masks and eye protection in situations with potential for contamination of skin or clothing or for splashes with these fluids; measures to prevent injuries from contaminated needles and other sharp items; and protocols for blood spill clean-up and laboratory safety.

UP were developed with the primary purpose of protecting the HCW from exposure to bloodborne pathogens, and were based on the principle that it was not possible to know which patients harboured bloodborne pathogens. UP were used in conjunction with category- or disease-specific isolation systems for patients with specific symptoms or infections[8,9].

There was also concern that routine and diagnosis-driven precautions were inadequate, in that they did not address potential transmission from body substances of asymptomatic colonized patients. To address this concern, a new isolation system called Body Substance Isolation (BSI) was created, in which barrier precautions were tailored to the activity performed rather than the diagnosis. This system extended barrier precautions to all direct contact with blood, body fluids, secretions and moist body substances, and with non-intact skin[10-12]. Gloves were used for all such contacts. Gowns, masks and eye protection were recommended for procedures in which soiling or splashing was anticipated. The principles of BSI were that all persons harbour potentially pathogenic agents in moist body sites and substances and that all persons are at risk of acquisition of organisms from inoculation of mucous membranes and non-intact skin. The goal of BSI was to prevent transmission by preventing contamination of the HCW's hands. There was confusion over whether or not hand washing was indicated after removal of gloves. The BSI precautions were not intended for control of droplet and airborne transmissions[13,14].

With both UP and BSI there was concern that increased use of gloves might create a false sense of security and that hand washing would be neglected. Also, UP and BSI did not address the potential for organisms such as *Clostridium difficile* and vancomycin-resistant enterococci (VRE) to contaminate the patient's immediate environment.

The US Centers for Disease Control and Prevention (CDC) revised their isolation guidelines in 1996 by selecting what were considered to be the best recommendations from each of the previous systems. A two-tiered system was developed with Standard Precautions (SP) for all patients and three categories of Transmission-based Precautions (TP) for specific infections that warranted additional measures. SP addressed the concern of transmission by contact with asymptomatic patients and with contaminated sources in the environment of the infected or colonized patient. Gloves were recommended for all contacts as indicated in BSI and, in addition, for contact with contaminated items. The three categories of additional precautions were based on known or presumed routes of transmission (airborne, droplet, contact) and patient characteristics. Contact precautions were more extensive than previously specified, in that barrier techniques were recommended for all persons entering the patient's room[14].

B. History of Canada's isolation guidelines

The Steering Committee on Infection Control Guidelines Development convened by the Bureau of Communicable Disease Epidemiology of the Laboratory Centre for Disease Control, Health Canada, published infection control guidelines for isolation and precaution techniques in 1985, which were revised in 1990[15]. These guidelines were written from a disease-specific perspective, listing specific precautions for disease and organism. The 1990 revision added symptoms as a basis for determining isolation precautions. Separate documents were issued in 1987, 1988 and 1989 outlining Universal Precautions[16-18], which were incorporated into the 1990 revision. Infection control guidelines for long term care were published in 1986 and revised in 1994[19]. These did not address specific issues related to isolation in long term care facilities, but referred to the 1990 Health Canada guidelines for isolation and precaution techniques[15]. In 1996, recommendations to prevent transmission of tuberculosis were published[20]. Revised guidelines for preventing transmission of bloodborne pathogens[21], hemorrhagic fevers[22], and VRE[23] were published in 1997.

C. Changing patient populations and health care delivery systems

Over recent years the patient population in acute care hospitals has shifted towards a group at higher risk for nosocomial infection. This shift has been the result of two events. First, the level of acuity of illness in acute care institutions has increased. Transfer of care for many conditions to the home or outpatient services has removed many low risk patients from the hospitalized population. In a survey of selected acute care hospitals in the United States, the proportion of total beds devoted to intensive care units (ICUs) increased significantly between 1988 and 1995[24].

Second, new technologies and aggressive treatments, many of which compromise host defences, have permitted patients with previously fatal diseases to survive. Transplantation and HIV infections have added to the numbers of high risk patients.

Health care delivery systems are being restructured. There is now a continuum of care from acute care hospitals to rehabilitation centres, chronic care facilities, nursing homes, adult residential care, ambulatory care centres and home care. Transfer of patients between institutions and between different levels of care within institutions, and transfer back to Canada of patients who had trauma or surgery while in a foreign country are frequent. The need for skilled nursing care in chronic care centres has increased[25], with some centres now delivering complex care such as intravenous therapy, hemodialysis or ventilator therapy[26,27]. These changes bring about increasing opportunities for transmission of infection.

D. Changing nosocomial infections

Most nosocomial infections in acute care settings are now caused by the patients's microbial flora[28], which invade and cause disease as a result of breakdown in defence mechanisms by iatrogenic procedures, therapies or underlying disease. The patient's flora frequently change after admission, as hospital strains of microorganisms, often resistant to antibiotics, are acquired[29,30]. Within the institutional setting, transmission may occur. There is increasing recognition that overt infection is the tip of the iceberg and that, although many patients are colonized, most remain asymptomatic. Colonized patients or carriers are not recognized unless universal screening is performed, yet they may serve as sources of transmission to other patients. However, universal or extensive screening of all patients is impractical and expensive, and there is no evidence that universal screening is beneficial[23]. The optimal approach towards prevention of nosocomial transmission from asymptomatic carriers is unknown.

The evolution of antimicrobial resistant organisms (ARO) such as methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant enterococcus (VRE) and Gram negative bacilli resistant to multiple antibiotics has presented a major challenge to the practice of infection control[31-34]. Current patient care practices appear to be inadequate to control transmission of these organisms in acute care settings[35-37]. It is unclear whether this is due to inadequacy of the practices, lack of compliance, inadequate staffing, or insufficient resources.

Transmission of community-acquired pathogens is now uncommon in adult acute care settings but remains a significant problem in pediatric and chronic care. The communicable community-acquired pathogens now encountered most frequently in hospital are respiratory and gastrointestinal viruses, which may be present in the asymptomatic patient for some days before the onset of symptoms or after symptoms have resolved[38-40].

E. Risk-benefit of prevention of transmission

Ideally, care should be provided in a manner that prevents all transmission of potential pathogens from all asymptomatic colonized, as well as symptomatic, patients in all health care settings. In reality this is not achievable. Transmission of infectious agents cannot always be prevented, and attempts to do so would entail exorbitant cost and restrictive measures that seriously interfere with the quality of life of the patient.

Thus, practices must be tailored to the level of care that is being provided and the inherent risk to the individual and the population if transmission occurs. Precautions that may be justified in terms of risk-benefit in an ICU or acute care ward may not be of equal benefit or indicated for a resident in long term care[41-43].

In most instances the precautions to apply are clear-cut, based on the evidence available. In other situations, certain measures may need to be customized for different types of health care facilities, based on assessment of risks and benefits. The benefit of reducing risk of transmission must be balanced against the cost (in quality of life, adequacy of medical care, and monetary outlay) of the precautions required to achieve this reduction in risk.

F. Isolation precautions used in Canada and the need for change

A survey of Canadian acute care hospitals in 1989 showed that 65% had adopted UP and 9% BSI, but that many had modified these systems[44]. In a survey of Canadian infection control personnel carried out by the Steering Committee in October 1996, 46% of institutions were using some form of routine precautions in addition to UP, 77% used additional precautions for certain specific infections, and 30% had problems with the published guidelines. Concerns expressed were the need for simplicity, consistency, and information on how to deal with ARO, and application of guidelines in long term care. These concerns emphasize the need for development of new guidelines for prevention of transmission of infection between patients in Canada.

The 1996 CDC guidelines have been adopted by some institutions in Canada. Although the principles of the 1996 CDC guidelines are sound, there are potential problems in implementation. Specific recommendations are open to different interpretations, for example in SP, the term "contaminated items" is not defined and could be interpreted as grossly soiled, or any item the patient may have touched. Recommendations for glove use and single room accommodation require modifications in pediatric settings[45,46]. The transmission-based precautions for children with respiratory tract infections are not consistent, and do not adequately address large droplet transmission[47]. In addition, the guidelines are designed for acute care settings and do not address the problem of the continuum of care common in today's health care settings.

Additional information is urgently needed about which patients are likely to become colonized and, of those colonized, which are at increased risk of disease, as well as which patient characteristics, patient care activities, and health care settings are most likely to result in transmission of microorganisms. Knowledge is evolving, and recommendations for prevention of transmission are only as current as the available data, to be adjusted as further knowledge is acquired.

G. Principles on which this document is based

This document is designed for use by infection control practitioners (ICP). Where individuals without experience in infection control are required to implement infection control precautions, it

is expected that the expertise of infection control practitioners will be sought by those responsible for the institution or region concerned. These guidelines should be used to develop specific recommendations for local use, taking into consideration local conditions such as the facilities available, risk of acquisition of infection, type of institution, type of care, and level of education and awareness of the personnel providing the care.

The current document recognizes certain principles:

Appropriate interventions can reduce transmission of infection in health care settings.

Infection control programs are designed to reduce risk of transmission to an acceptable level; zero risk is not attainable, and the consequences of transmission must be balanced against the consequences of precautions taken.

Precautions should be feasible within the context of existing health care facilities in Canada, recognizing the ongoing changes in systems of health care delivery.

Interventions may vary between acute care, chronic care, and community health care settings. Local epidemiology should be considered in the design and application of infection prevention and control interventions.

The patient population is becoming increasingly immunocompromised and at greater risk for nosocomial infection.

Potential pathogens may be transmitted from symptomatic and asymptomatic individuals.

Certain routine practices should be used for all patients regardless of diagnosis and tailored to the characteristics of the patients and their environment.

Patients known or suspected to be infected or colonized with certain microorganisms will require additional precautions based on the modes of transmission of these microorganisms.

II. Principles of Transmission of Microorganisms

In hospital epidemiology, routes of transmission of infectious agents have been classified as contact, droplet, airborne, common vehicle and vectorborne[48] (Figure 1 illustrates the routes of transmission). Contact transmission is the most common route of transmission of microbes from symptomatic or asymptomatic patients in hospitals. On pediatric wards, droplet transmission is also common. Airborne and common vehicle transmission occur less frequently, and vectorborne transmissions are rare.

A. Contact transmission

Contact transmission includes direct contact, indirect contact and droplet (large droplet) transmission. Although droplet transmission is a type of contact transmission, it is considered separately as it requires different precautions.

1. Direct and Indirect Contact

Direct contact transmission occurs when transfer of microorganisms results from direct physical contact between an infected or colonized individual and a susceptible host (body surface to body surface). Indirect contact involves passive transfer of microorganisms to a susceptible host via an intermediate object, such as contaminated hands that are not washed between patients, or contaminated instruments or other inanimate objects in the patient's immediate environment.

Routine patient care practices should prevent most transmission by this route. Additional precautions are required when routine practices are not sufficient to prevent transmission of certain microorganisms. The need for additional precautions will depend on the routine practices used by an institution, the degree of compliance with these practices, and the microorganisms encountered.

Additional measures may be warranted for:

- Infectious agents of very low infective dose (e.g. rotavirus)
- Situations in which extensive contamination of the patient's environment is expected (e.g. an incontinent patient with diarrhea that cannot be contained within a diaper)

Patients infected or colonized with epidemiologically important microorganisms that may be transmitted easily by contact with the patient's intact skin or with contaminated environmental surfaces (e.g. *Clostridium difficile*, MRSA, VRE).

2. Droplet Transmission

Droplet transmission is a form of contact transmission but requires special considerations. Droplet transmission refers to large droplets, ≥ 5 µm in diameter, generated from the respiratory tract of the source patient during coughing or sneezing, or during procedures such as suctioning or bronchoscopy. These droplets are propelled a short distance, < 1 m, through the air and deposited on the nasal or oral mucosa of the new host. Evidence for a short dispersal distance comes from observations of meningococcal transmission in army barracks, where carriage rates increased when beds were < 1 m apart[49]. In a more recent school outbreak of meningococcal disease, transmission rates were higher in classrooms where chairs were < 102 cm apart[50].

Large droplets do not remain suspended in the air. Special ventilation is not required since true aerosolization does not occur.

Some organisms transmitted by this route are very fragile and do not survive in the environment of the patient or on hands (e.g. *Haemophilus influenzae* type b, *Neisseria meningitidis*, *Bordetella pertussis*).

Other organisms expelled in large droplets, especially respiratory viruses, remain viable in droplets that settle on objects in the immediate environment of the patient. Viruses such as respiratory syncytial virus (RSV), influenza, parainfluenza and rhinovirus survive long enough on surfaces to be picked up on the hands of patients or personnel[51-54]. Respiratory viruses may be transmitted by direct deposition of infectious droplets onto the nasal mucosa or conjunctiva (large droplet), or by inoculation of these membranes by contaminated hands (contact)[54-57]. In contrast to the eyes and nose, the mouth is an inefficient portal of entry for RSV[56] and rhinovirus[54]. Rhinovirus was shown to be more efficiently transmitted by hand contact than by large droplets in one study[58], although in a later study, droplet transmission appeared to be more important[59].

Organisms transmitted by this route are especially of concern in pediatrics, as respiratory viral infections are a significant nosocomial problem in children. Serious outbreaks also occur in immunocompromised adults[60-63] and the institutionalized elderly[64,65], and RSV may be a problem in intubated adults[66].

B. Airborne transmission

Airborne transmission refers to dissemination of microorganisms by aerosolization. Organisms are contained in droplet nuclei (the small airborne particles, < 5 μm, that result from evaporation of large droplets) or in dust particles containing skin squames and other debris that remain suspended in the air for long periods of time[67]. Such microorganisms are widely dispersed by air currents and inhaled by susceptible hosts who may be some distance away from the source patient, even in different rooms or hospital wards. Control of airborne transmission is the most difficult, as it requires control of air flow through special ventilation systems.

There is evidence for airborne transmission from source patients with tuberculosis[68-72], varicella[73-75], localized zoster[75-77], measles (rubeola)[78-81], and smallpox[82]. Some authorities have considered other organisms to be transmitted person-to-person by the airborne route, but extensive review of the literature has not revealed convincing evidence for this.

Whether or not influenza is naturally transmitted by the airborne route is controversial[14,83]. Contact with respiratory secretions and large droplets appears to account for most transmissions. An outbreak of influenza on an airliner has been considered indicative of airborne spread, but large droplet spread could have been responsible, in that passengers were crowded together and moved about for several hours in a small grounded aeroplane[84]. Although experimental airborne transmission of influenza A virus to mice has been reported[85] there is no definite evidence of such transmission in humans. The pattern of spread in a nursing home outbreak was suggestive of contact rather than airborne transmission, in that patients who were tube fed or required frequent suctioning had higher infection rates than those who did not require such care[86].

The mode of transmission of hemorrhagic fever viruses such as Lassa, Ebola, Marburg and others is also controversial. Transmission requires close personal contact[87], probably via contact and large droplet routes[88,89]. Airborne transmission may have been involved in one outbreak of Lassa fever related to an index case with pneumonia[90]. There is no evidence of airborne transmission of Ebola virus to humans[88].

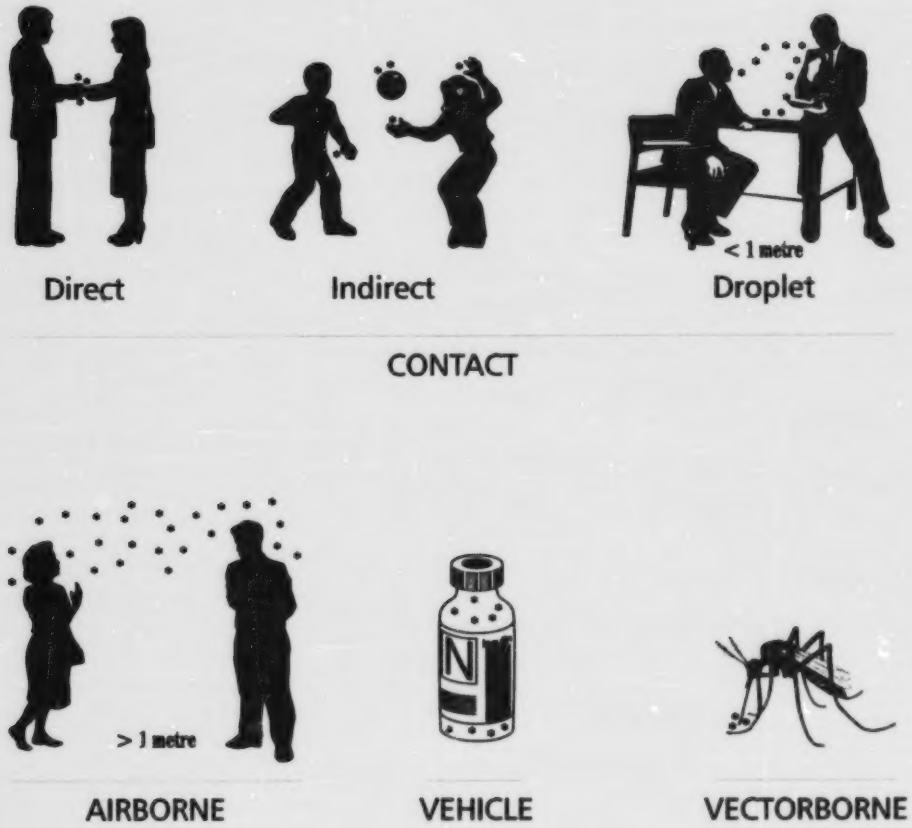
C. Common vehicle transmission

Common vehicle transmission refers to a single contaminated source such as food, medication, intravenous fluid, equipment, etc, which serves to transmit infection to multiple hosts. Such transmission may result in an explosive outbreak. Control is by maintenance of appropriate standards in the preparation of food and medications and in decontamination of equipment.

D. Vectorborne transmission

Vectorborne transmission refers to transmission by insect vectors and is prevented by appropriate hospital construction and maintenance, closed or screened windows, and proper housekeeping. Such transmission has not been reported in Canadian hospitals.

FIGURE 1: How Microorganisms Are Acquired



III. Antimicrobial Resistant Organisms (ARO)

Currently, the major concern about the adequacy of isolation practices is the ability to control transmission of ARO. The emergence and rapid dissemination of VRE, ongoing problems with MRSA and resistant Gram negative rods, and the emergence of vancomycin-resistant *S. aureus*[91-95] point to the seriousness of this problem.

A. Antimicrobial resistant organisms (ARO) in acute care facilities

The extent of the emergence of antibiotic resistance is the result of intensive and inappropriate use of antibiotics, both in hospital and in the community. Control requires improved strategies for antibiotic use[31,32,94]. Colonization with ARO occurs most frequently in intensive care units (ICUs), which bring together critically ill patients who have less resistance to colonization, in a setting of heavy exposure to antibiotics and frequent hands-on care by health care personnel[24,29,32,96]. Colonization is more frequent than disease, and widespread transmission may have occurred by the time an ARO outbreak is recognized[97].

1. Transmission of ARO

Transmission of ARO between patients in the acute care setting is well documented and of major concern. Predisposing factors for acquisition of ARO include antimicrobial therapy, severe illness, prolonged hospital stay, intensive care admission, surgery, and invasive procedures and devices[98]. Risk factors for MRSA acquisition include invasive procedures, prior treatment with antibiotics, prolonged hospital stay, stay in an intensive care or burn unit, surgical wound infection, and close proximity to a colonized patient[99-101]. VRE colonization has been related to antibiotic therapy, especially third generation cephalosporins and vancomycin, duration of hospital stay, neutropenia, malignant disease, organ transplantation, proximity to another case and sharing staff with another case[96,102-104]. Skin colonization with VRE is more frequent in patients with diarrhea or incontinence[105,106] and has been associated with a higher rate of bacteremia[105]. In an outbreak of multiresistant *Klebsiella*, patients treated with combinations of quinolones and antibiotics active against anaerobes, those with urinary catheters and those with severe underlying illness were at highest risk of colonization[107]. Risk factors for colonization with extended-spectrum beta-lactamase (ESBL)-producing Gram negative rods in a surgical ICU included gastrointestinal surgery, length of stay, and intensity of nursing care required[108]. Prior exposure to third generation cephalosporins was a risk factor for acquisition of multiresistant *Enterobacter*[109,110] and *Klebsiella*[111].

Contamination of the inanimate environment around patients with MRSA and VRE has frequently been documented[36,42,96,100,102,104,108,112-116]. In one study, contamination with VRE was widespread in rooms of patients with diarrhea, otherwise it was confined to patient gowns, bedclothes and bed rails[102]. In another, wound or urine colonization with MRSA was six times more likely to result in environmental contamination than MRSA colonization of other body sites[117]. However, whether or not the environment contributes significantly to transmission remains controversial. It is difficult to separately assess transmission via contaminated hands and transmission via contaminated objects. There is little evidence that the environment plays a role in transmission of *S. aureus*, except possibly in burn units[42,100,118,119]. On the other hand, outbreaks of VRE have been linked to electronic thermometer probes[120,121] and to a microsphere bed[122].

Outbreaks of ARO do not necessarily represent nosocomial transmission. Endogenous ARO may be selected by antibiotic therapy[96]. In an outbreak of multiresistant *Enterobacter*, multiple strains were involved, cross-infection did not occur, and infection risk was associated with treatment with broad spectrum β-lactam antibiotics[123]. Multiple importations of different strains have been reported with MRSA[124,125] and VRE[36]. In some areas, MRSA is now widespread in the community, and increasing numbers of patients are colonized with MRSA on admission[125-130]. Efforts to eliminate ARO may be unsuccessful and discouraging if potential colonization on admission is not considered.

2. Control of ARO in Acute Care Facilities

Control of transmission of ARO in acute care centres is difficult. It is not possible to identify all colonized patients, to predict risk for colonization, or to determine which colonized patients are more likely sources of transmission and warrant more stringent precautions. It is questionable whether known asymptomatic carriers should be treated differently from unrecognized asymptomatic carriers. If precautions are taken only with identified carriers, transmissions and outbreaks may occur[31,32,34,131]. Just as blood precautions taken only with known infected patients proved inadequate to prevent transmission of bloodborne pathogens, isolation of patients only when they are known to carry ARO may prove to be inadequate as well.

Measures currently recommended for control of ARO in acute care centres are stringent and would require exorbitant use of time and resources and reorganization of daily hospital routine if applied to all patients admitted. Theoretical options to prevent ARO transmission in acute care settings are to increase the extent of barrier precautions taken empirically for all patients or to screen all patients for ARO[31]. While screening of all patients to determine whether they harbour any ARO is not possible, targeted screening for specific organisms (e.g. VRE, MRSA)[31,43] in specific high risk areas or during outbreaks may be indicated to identify patients requiring additional precautions.

Barrier techniques have been successful in controlling some outbreaks of ARO but not others[96,132]. In some instances extensive barrier precautions have been required to control ARO transmission[102,113,127,133-135] while in others, simpler precautions such as use of gloves and

single rooms[129,136,137] or gloves alone[138] have sufficed. Precautions based on the site of colonization have been used to control MRSA transmission[42,112,139].

Correction of under-staffing was an important factor in elimination of endemic MRSA in a neonatal ICU[140]. In a surgical ICU, rates of colonization with resistant Gram negative rods decreased with reorganization of nursing workload and work methods[108].

Control of MRSA may be more feasible when it is newly introduced into a centre. Boyce reviewed reports of attempted MRSA eradication and found that it was successful in all 11 instances where fewer than 20 cases had occurred, in 71% of outbreaks with 20-39 cases and in 10% of those with 40 or more cases[132]. Control of VRE may be more successful if VRE is localized to a single hospital area[102,133] than if it is widespread and endemic[35-37].

Aggressive attempts to eradicate MRSA are warranted when there is a high incidence of serious disease due to MRSA, when it is newly introduced into a centre, in high risk areas such as intensive care or burn units, or when the prevalence of MRSA is responsible for substantial vancomycin use[141]. If there is increasing prevalence of MRSA acquired in the community, use of highly aggressive strategies in hospital for patients carrying MRSA may have little impact on transmission but may be indicated when clusters or outbreaks occur[129].

The literature suggests that decreasing the use of certain antibiotics can result in a major decrease in the prevalence of ARO[31-33,142,143] and may be more effective than increased use of barrier precautions. In one centre, restriction of the use of cefotaxime and clindamycin was followed by a decrease in endemic rates of VRE after barrier precautions had failed[143].

B. ARO in other health care settings

Most long term care residents with MRSA[118] or VRE[144,145] became colonized during previous admission to acute care centres. Long term care centres may then become sources for re-introduction into acute care centres[42]. Because of persistent carriage and slow turnover of residents, there is a cumulative increase in prevalence over time[144]. Multiple strains are frequently found[144-146].

The prevalence of MRSA in nursing homes in the United States is now 9-34%[30]. Similar data for Canada are not yet available, but prevalence rates are thought to be lower.

Risk factors for colonization with ARO in long term care include poor functional status, prior antibiotic therapy, open wounds or decubitus ulcers, urinary catheters and feeding tubes[27,147]. Colonization with MRSA has been associated with open wounds, decubitus ulcers, gastrostomy tubes, urinary catheters, and multiple functional disabilities[100,148,149]. Colonization with resistant Gram negative rods has been associated with urinary catheterization, wounds, inflammatory

bowel disease, chronic renal disease and prior pneumonia[150] and with decubitus ulcers and prior antibiotic use[151].

Unlike their effect in acute care, MRSA and VRE cause little morbidity in long term care centres[100,118,144,152,153]. The rates of transmission of MRSA and VRE in long term care centres are also low[118,144,148,153]. In a prospective study, 25% of MRSA carriers were colonized on admission and only 10% of residents at risk subsequently became colonized[118]. Transmission of MRSA, VRE or gentamicin-resistant enterococcus to room-mates is rare[118,144,145].

In long term care centres, *Streptococcus pneumoniae* is the most important cause of pneumonia. Multidrug-resistant *S. pneumoniae* has emerged, causing pneumonia and in some cases pneumococcal bacteremia[154-156].

Infection control precautions used for ARO in long term care vary from attempts to carry out stringent precautions designed for acute care to few or no precautions. Simple barriers have frequently been advocated[42,157-160].

There is concern that contamination of the environment by colonized residents of long term care may result in transmission, especially in shared living areas. In two studies, MRSA[118] and VRE[144] were frequently isolated from environmental surfaces in the rooms of residents, but were often not the same strain as that carried by the resident, and cultures from surfaces in common living areas were rarely positive.

Colonization with ARO may persist for prolonged periods. In one study, 80% of MRSA carriers remained positive for at least three months[118]. Decolonization of carriers of MRSA has at times been successful but is frequently followed by relapse[42,100,160]. VRE colonization may also persist for months[161,162]. In Toronto, a study of dialysis patients suggested that 66% of patients followed for a year had either persistent or intermittent long term carriage of VRE[163,164].

There are few data at present concerning transmission of ARO in ambulatory or home care settings[165,166]. Transmission of multidrug-resistant tuberculosis has been reported in an HIV clinic[167]. It is thought that resistant strains of *Burkholderia cepacia* may be transmitted between patients with cystic fibrosis in ambulatory care settings[168]. Penicillin resistant pneumocccus occurs mainly in the community, but the epidemiology of transmission is not yet well defined.

IV. Assessment of Risk

A. Risk factors for transmission, colonization, and disease

1. Transmission

Microorganisms have to gain access to the host for colonization and disease to occur. The portals of entry are similar to the portals of exit and include the respiratory tract, gastrointestinal and urinary tracts and skin lesions. If the portals of entry and exit can be controlled, transmission is unlikely to occur.

The characteristics of the particular microbe affect the ease of its transmission. Organisms that can survive environmental conditions and can live on inanimate objects such as patient care equipment are more likely to be passed between patients[30,96]. A long incubation period increases the opportunity for dissemination of microorganisms from an asymptomatic host. A large number of viable organisms increases the degree of environmental contamination and consequently enhances transmission potential, as does a low infective dose.

2. Colonization

With most microbes, colonization is far more frequent than symptomatic infection (disease). Abnormal colonization of the nasopharynx with aerobic Gram negative rods occurs with increased severity of illness, malnutrition, major surgery, alcoholism and diabetes[29]. The presence of normal bowel flora is a defence mechanism against colonization of the gastrointestinal tract by exogenous organisms. Colonization with *S. aureus* is common in newborns, hemodialysis patients, intravenous drug users, and patients with diabetes mellitus or severe skin disorders[42].

Disturbances of normal flora by antibiotics enhances overgrowth of endogenous aerobic Gram negative rods and enterococci, and increases risk of colonization with exogenous organisms, including antibiotic resistant bacteria and yeasts[29,30]. Prolonged carriage of ARO is the norm in some populations. Carriage of resistant strains of *Pseudomonas aeruginosa* or *Burkholderia cepacia* is chronic in persons with cystic fibrosis. Persistent VRE colonization has been demonstrated in dialysis patients[163] and other[161,162] populations.

Additional factors that may facilitate acquisition of microorganisms are breaks in the skin and breaching of normal barriers (such as by endotracheal tubes, indwelling urethral catheters and intravascular devices).

3. Disease

Whether or not transmission results in disease depends on the pathogenicity and virulence of the microbe, the inoculum size and the integrity of host defences. Some microorganisms are inherently pathogenic, i.e. capable of causing infection in any host (e.g. varicella) whereas others are opportunists causing infection only under special circumstances (e.g. coagulase-negative staphylococci in prosthetic joint or valve infections). Virulence refers to the severity of the disease caused (e.g. Ebola virus, high; rhinovirus, low). Several factors contribute to the virulence of an organism: toxin production, invasiveness, presence of capsule, adherence mechanisms and ability to survive inside host cells.

Host defences, both nonspecific (e.g. normal flora, intact skin, neutrophils, macrophages) and specific (antibodies, cell mediated responses) may be altered by age, disease, genetic factors, drugs and invasive procedures. Neutropenic patients colonized with VRE are at risk for VRE bacteremia[169]. Skin and nasal colonization are risk factors for bacteremia in patients with indwelling intravascular devices[105,170].

B. Role of the inanimate environment

Environmental factors may either assist or impede the transmission of microbes. The environment may be conducive to growth and survival of the organism. Overcrowding or sharing of equipment may increase the chance of exposure to the microbial flora of other patients.

Respiratory viruses[51-54] and rotavirus[171-173] persist for prolonged periods on inanimate objects, and transmission of RSV from the inanimate environment has been demonstrated[58]. Bedside tables and bedrails may be contaminated by VRE[102,116] and MRSA[117]. Call bells may become contaminated with VRE[116]. Environmental contamination may be important in transmission of relatively hardy bacteria such as enterococci[102,114] and spore-forming bacteria such as *Clostridium difficile*[174,175]. The mobile environment, i.e. equipment that is shared among patients, may be a source of transmission. Transmission of VRE and *C. difficile* has been linked to contaminated thermometers[120,121,176,177]. Contaminated blood pressure cuffs have been implicated in transmission of *C. difficile*[178] and *Klebsiella*[179]. Recent studies have shown that stethoscope diaphragms and otoscope specula become contaminated with microorganisms including MRSA[180-184]. Transfer of microbes to skin via stethoscopes was demonstrated in an experimental setting[185].

Many patient care items, including bedside tables and bed rails, may not be cleaned routinely by housekeeping or other personnel[144], especially if responsibility for cleaning of specific items is not clearly assigned[186]. Although there has been much concern about the most appropriate cleaning agents[187], the actual method of cleaning may be more important than the agent used[188].

The environment may play a larger role in transmission of certain pathogens than previously appreciated, reinforcing the importance of minimizing environmental contamination by patient excretions and secretions, avoiding unnecessary hand contact with environmental surfaces, and ensuring adequate resources for housekeeping.

C. Assessing risk of transmission

Risk of transmission of microorganisms between patients involves factors related to the microbe, the source patient, the patient care environment and the new host (Table 1).

Patients in intensive care units are at increased risk of colonization with ARO as a result of antibiotic pressure and disturbance of normal flora and defence mechanisms by severe underlying disease[24,29,98]. The need for frequent direct hands-on care increases the risk of acquisition.

Less is known about which colonized patients are more likely to be sources of transmission to others. Patients with diarrhea who are incontinent and thus contaminate their environments, or those with colonized open wounds or indwelling urinary catheters are likely sources of transmission[117,141,189]. Skin colonization with VRE has been found to be more common in patients with diarrhea or fecal incontinence[105]. Patients with extensive burns or chronic dermatitis may be more likely to transmit *S. aureus*[42].

Recommendations regarding the precautions required to prevent transmission of microorganisms within the health care environment are based on our knowledge of mechanisms for and risk of their spread. Taken into consideration are the likelihood of transmission between patients and the outcome of such transmission to the individual patient, facility and community. Table 1 provides information that may be used to assess risk of nosocomial transmission in specific circumstances. Recommendations stratified by risk have been used in other areas of infectious disease management, e.g. antibiotic prophylaxis for endocarditis[190] and post-exposure prophylaxis for occupational exposure to HIV[191,192].

An example of risk stratification was described by one centre that successfully reintegrated patients colonized with VRE into regular ward care based on likelihood of transmission[164]. Those patients with a good level of personal hygiene, fecal continence, lack of severe illness, and admission to a regular medical ward were integrated; others remained in single rooms with barrier precautions.

TABLE 1. Risk Factors for Transmission and Disease after Exposure to Infected or Colonized Source Patient

	Higher Risk of Transmission	Lower Risk of Transmission
Source Patient	incontinent of stool; stool not contained by diapers diarrhea draining skin lesions or wounds not covered by dressings copious uncontrolled respiratory secretions patient in intensive care unit or requiring extensive hands-on care patient has invasive devices poor compliance with hygienic practices and infection control precautions, e.g. confused patient	continent good hygiene skin lesions or wounds covered by dressings able to control respiratory secretions capable of self care able to comply with infection control precautions
Microorganism	able to survive in the environment (e.g. VRE, *C. difficile*, rotavirus) presence of large inoculum low infective dose, e.g. *Shigella* high pathogenicity, high virulence airborne spread by contact able to colonize invasive devices propensity for asymptomatic/carrier state	unable to survive long in the environment presence of low inoculum high infective dose, e.g. *Salmonella* low pathogenicity, low virulence short period of infectivity
Environment	inadequate housekeeping shared patient care equipment without cleaning between patients, e.g. thermometer bases, commodes crowded facilities shared facilities (e.g. toilets, bath, sinks) high patient-nurse ratio absence of negative pressure rooms (if airborne)	appropriate housekeeping dedicated equipment adequate spacing between beds own bathroom facilities low patient-nurse ratio
Host Patient	patient in intensive care unit or requiring extensive hands-on care patient has invasive procedures or devices non-intact skin debilitated, severe underlying disease extremes of age recent antibiotic therapy immunosuppression	able to do self care no indwelling devices intact skin and mucous membranes strong immune system

D. Transmission in non-acute care settings

1. In Long Term Care

Outside of acute care hospitals, health care is provided in a variety of chronic care facilities, ranging from convalescent homes and rehabilitation centres to centres for residents with psychiatric or physical disability and residential centres for the elderly. Establishing a balance between prevention of infection and quality of life for residents in such centres is of special concern. Participation in group activities is part of daily life as well as being therapeutic, and isolation or cohorting may be detrimental to the resident[27,42,186].

It is well known that transmission of infections occurs in long term care facilities. The risks to residents and the circumstances of the care given, however, are very different from in the acute care setting, making direct application of traditional isolation and precaution techniques difficult, if not impossible. Impediments to such application include shared rooms and toilets, inadequate hand washing facilities, common dining rooms and living areas, wandering or confused residents, high resident to staff ratios, non-professional staff, and limited resources for infection control[147,193-195]. Conversely, characteristics that support a lower risk of transmission include residents who are generally not severely ill, have few invasive devices and are usually fully dressed with minimal contamination of the environment[193]. The philosophy of long term care to provide a home-like setting with participation in activities of daily living requires a balanced approach offering a safe environment without undue restrictive measures that could be detrimental to the individual's well-being or quality of life[41].

While ARO in long term care (discussed earlier in Section III.B.) has been the focus of much attention, the risk of transmission is low and other infections play more of a role in the health of the residents[26,27,196]. Influenza A causes significant morbidity and mortality[60,86,197,198]. Other respiratory viruses, pertussis, and *Chlamydia pneumoniae* may cause significant morbidity[84,85,199-202]. Outbreaks of severe gastroenteritis occur, which may be foodborne[26,27,203-208]. Tuberculosis transmission has been reported[209-211]. Skin infections are a problem in the elderly[26,27,212], and scabies outbreaks have been reported[213,214].

2. In Ambulatory Care

Transmissions may occur in hospital emergency rooms, clinic waiting areas and physicians' offices. Theoretically the risk is less because of shorter contact time, lower number of contacts, and a generally healthier population. Transmission may occur in large, crowded waiting rooms and other common areas.

There are limited data on the transmission of infection between patients in ambulatory care[215-217]. Most infections resulting from ambulatory care have been related to surgery or other invasive procedures performed in these settings[217,218] , problems with aseptic practices, or inadequate cleaning and disinfection of equipment and supplies between patients.

The risk of transmission between patients is less than in hospitalized patients, and it would be inappropriate to impose the same precautions, which could entail unnecessary costs and hinder the cause of infection control[217].

Transmission of airborne infections such as measles[78,80,81,215] and tuberculosis[216] occurs in ambulatory care settings. Exposure in ambulatory settings was responsible for a significant proportion of cases of measles reported in the United States recently[219]. Tuberculosis has been transmitted in clinics where patients with HIV were being treated[216,220,221]. Several outbreaks of keratoconjunctivitis have been described[215-217]. Transmission of varicella and respiratory viral infections in ambulatory care probably occurs but has not been reported, perhaps because of inability to distinguish between such transmissions and community exposures during epidemics. In one study, a recent visit to a pediatrician's office was not associated with increased risk of acquisition of respiratory or gastrointestinal viral infections[222]. These viral infections reflect activity in the community, and risk of exposure in medical settings may not be higher than in the community.

3. In Home Care

There is little evidence to suggest that provision of health care in the home setting results in substantial disease transmission. Most infections in this setting are related to procedures and devices such as urinary or intravascular catheters. Risks of transmission relate to aseptic practices of the caregiver, cleaning and disinfection of equipment and supplies used between clients, and environmental cleanliness[42,218,223-228].

E. Balancing the impact of transmission and the impact of prevention strategies

The costs associated with infection prevention must be balanced against the costs of infection transmission (Table 2). Determining which precautions to implement must take into consideration available resources, cost-effectiveness, time constraints, adverse effects or complications of the proposed control measures and effect on the prevention of future cases. Considerations sometimes forgotten are the costs of prevention (gloves, gowns, masks, dedicated equipment, special ventilation, personnel, the use of a room with multiple beds for only one patient), possible decreased intensity of care provided to the patient for whom there are transmission precautions, and the effects of enforced solitude on the patient[48,229,230].

TABLE 2.
Impact of Transmission and Impact of Prevention Strategies

Possible Consequences of Transmission	Possible Consequences of Preventive Measures
disease - consider severity (e.g. mild upper respiratory tract infection vs potentially fatal pneumonia) prolongation of hospital stay cost of specific therapy cost of additional precautions because of acquisition of disease/colonization cost to others and to institution in the event of an outbreak alteration in institutional flora to more resistant pattern requiring broader spectrum empiric therapy ethical implications of the right of other patients to be protected from harm consequent to an exposure legal implications	equipment required for barrier precautions, single rooms, special ventilation increased time and organization required for care inconvenience imposed by the preventive measures possible decreased intensity of care, frequency of HCW visits use of a room with multiple beds for a single patient enforced solitude for patient reduced quality of life for patient psychological effects on patient of being perceived as "infectious" ethical implications of the restriction of rights of the individual patient imposed by precautions

V. Patient Care Practices To Prevent Transmission

A. Hand washing

The hands of the HCW are continuously in contact with patients and their environments and are therefore the surfaces most at risk for contamination during patient care and thus for transfer of organisms between patients, to the HCW and to environmental surfaces.

The efficacy of hand disinfection in reducing nosocomial infections was initially recognized by Semmelweiss in 1847 and has been documented repeatedly since[231]. Hand washing, if properly performed, eliminates transient microbial contamination acquired from contact with the patient or with contaminated inanimate objects[232-234].

However, ensuring that this basic activity is performed routinely is a major challenge. Observational studies have repeatedly documented that health care workers frequently fail to wash their hands, whether they are caring for patients in adult[235-241], pediatric[242] or neonatal[243,244] ICUs, for patients requiring transmission precautions[245], or for patients in community hospitals[246] or long term care centres[247].

Decreased nosocomial infection rates have been observed when hand washing compliance improved[248,249]. However, successfully training HCWs to improve their hand washing behaviour is notoriously difficult, and hand washing promotional and educational programs have had only a short-term effect[237,238,248,250]. Ongoing direct observation and daily feedback on performance appear to be effective methods to increase compliance[250] but are not feasible on a continual basis.

Stated impediments to hand washing include lack of time, under-staffing, inaccessibility of sinks, inadequate supplies for hand washing (e.g. hand towels, soap), poorly accepted hand washing products, concern over the deleterious effects of frequent washing on hands, belief that washing is not necessary if gloves are used and, perhaps more importantly, lack of peer pressure to wash hands and scepticism about the value of washing when the hands are not visibly soiled[233,237,251-253]. Unless these issues are addressed, recommendations relying on routine hand washing to reduce transmission from asymptomatic patients will be ineffective. Hand washing by HCWs may improve if patients demand it[254,255].

Concerns over lack of time and the deleterious effects of hand washing lead to the question of whether current expectations for hand washing frequency, especially in ICUs, are realistic[241]. One estimate of the time required for 100% compliance with hand washing in an ICU was 1.33 hours per 8 hour shift[256]. Expected frequencies are not stated in publications.

Larson has suggested that there may not be a substantive cost/benefit ratio in intensive, focused and continuous education to improve hand washing and that, instead, perhaps the focus should be on making it more difficult for the HCW not to wash hands through environmental controls, automation, or administrative mandate[237].

There is controversy over whether antiseptics or soap should be used[257,258]. Soap should remove most of the transient flora[234]. However, antiseptics are more effective than soap when there is heavy contamination. Hand contamination with *Enterobacter cloacae* was eradicated with the use of alcohol-chlorhexidine hand rinse when bland soap hand wash had failed[259]. Hand washing with soap may not remove VRE[260]. Studies comparing chlorhexidine with soap for removal of *C. difficile* have had contradictory results[261,262].

Hand cleansing products have to be gentle enough to protect the hands during repeated washings yet potent enough to eliminate microorganisms[233]. Contrary to common belief, antiseptics are not necessarily more harsh on skin than bland soap. In a study comparing skin damage after repeated washing with water alone, bar soap, chlorhexidine, or povidone, the most damage was caused by povidone; damage with chlorhexidine was less than with bar soap and no different from that with plain water[263].

Waterless antiseptic hand rinses are superior to soap and water in removing microorganisms from the skin and are an effective alternative to hand washing[258-260,264,265]. Waterless antiseptic hand rinses with emollients such as glycerol have been better tolerated than liquid soaps or antiseptics[265,266]. The former are also more convenient, as they may be located at the patient's bedside or on a mobile chart rack and require less time to use[256]. Increased compliance was observed with introduction of alcohol-chlorhexidine hand rinse in one centre[236]. Waterless antiseptic hand rinses are particularly useful in situations where access to appropriate hand washing facilities (e.g. sinks, hand towels, soap) may be limited, such as in health care in the home.

B. Gloves

In UP, gloves are used to reduce the risk of health care worker exposure to blood[8]. The BSI system advocates glove use when contact with any moist body substances, mucous membranes or nonintact skin is anticipated[10]. Gloves are changed between patients and before or after certain activities with the same patient. The 1996 CDC guideline extends routine glove use to contact with contaminated environmental objects but does not define contamination[14].

In current guidelines, the use of gloves is not a substitute for hand washing, but an additional measure. In view of the difficulties in compliance with hand washing, HCWs may see the use of gloves as an alternative method of preventing hand contamination, since gloves become contaminated rather than hands. Because hands can become contaminated through glove

defects or during glove removal, it is recommended that hands be washed after removal of gloves[14]. Contamination of HCW hands despite glove use was demonstrated after experimental inoculation of gloved hands[267] and after 13% of contacts with patients' mucous membranes[268]. Washing of gloved hands with soap, chlorhexidine or alcohol was not effective in removing inoculated organisms, and this practice is not acceptable[261,267].

Use of clean disposable gloves over unwashed hands has been shown to be as effective as antiseptic hand washing in reducing fingertip contamination[269]. The effectiveness of gloves in reducing the nosocomial infection rate is less well established. Routine use of gloves plus disposable gowns for all patient care reduced the infection rate in a study in a pediatric ICU[270]. On the other hand, routine use of gloves, gowns, and masks had no effect on infection rates in a study of neutropenic patients[271]. Infection rates decreased after increased use of gloves (as per BSI) in one medical centre, but other factors, such as change in patient characteristics, may have contributed to this decrease[272]. Routine glove use as per BSI was associated with reduced transmission of *C. difficile*[273]. Routine use of gloves and dedicated stethoscopes controlled outbreaks of MRSA and VRE in one ICU[131]. In another ICU, an outbreak of MRSA was controlled by use of gloves for all contact with patients and their immediate environments[136].

Other studies have shown that selective use of gloves for contact with patients known or suspected to be carrying specific microorganisms was effective in decreasing transmission[129,274,275].

If HCWs fail to wash their hands after contact with a potentially colonized body surface, they may not be willing to remove their gloves AND wash their hands after such contact. Nevertheless wearing gloves may reduce the degree of hand contamination in situations where hand washing is poorly performed or frequently forgotten. It has been suggested, but not proven, that compliance with glove use may be better than with hand washing because the former is more easily monitored[5]. In fact, in one study HCWs who wore gloves were more likely to wash their hands than those who did not[247].

Glove use is not without problems. Use of gloves may provide a false sense of security, leading to decreased hand washing. Transmission of infectious agents between patients has occurred when HCWs did not change gloves between patients[178,276,277]. Failure to remove gloves after patient care has been implicated in contamination of blood pressure cuffs with *C. difficile*[178]. In a long term care setting in which BSI was used, gloves were worn for 82% of indications but were changed appropriately only 16% of the time[247]. If HCWs fail to remove gloves between patients, the benefit of reduced hand contamination may be offset by increased transmission to other patients. Failure to remove gloves after patient care may result in contamination of the environment.

Extensive glove use is suspected of causing an increased incidence of contact allergy to latex[278]. There has been concern about the relative efficacies of vinyl versus latex gloves. Either should suffice if gloves are of good quality[232,279].

It is not known how much an increase in glove use will contribute to a decrease in the transmission of organisms other than bloodborne pathogens. For the latter, gloves are used to prevent direct transmission to the HCW through skin lesions. Other organisms may be transmitted by indirect contact, from patient to patient via the hand of the HCW or via contaminated equipment. Organisms that are transiently carried on the hands should be removed by washing and, in most instances, washing should be as effective as using gloves. Whether compliance with appropriate use of gloves will be any better than with hand washing remains to be demonstrated. If not, the extensive use of gloves will increase the cost of care without benefit and may not be justified.

Since gloves cannot replace hand washing, and if frequent hand washing is not feasible, one alternative approach is the development of "no-touch" techniques for certain aspects of patient care[280]. Such techniques may reduce opportunities for hand contamination and the frequency of hand washing required during care of an individual patient. Planning of the sequence of care activities with a specific patient may reduce the need for hand washing.

C. Gowns

Long-sleeved gowns serve to protect the forearms and clothing of the HCW from splashing and soiling with body substances. In UP, BSI and SP, gowns are recommended during routine patient care activities in which this is likely to occur.

There is little evidence that routine use of gowns is beneficial in the control of nosocomial infections. Routine gown use has had no effect on nosocomial infection rates in neonatal[281-283] or pediatric ICUs[284] or on rates of neonatal colonization on postpartum wards[285,286]. In one report, transmission of VRE in a medical ICU was no different with routine use of gloves alone than with gloves plus gowns[137].

On the other hand, a VRE outbreak that was not controlled when gloves were used for patients known to be colonized with VRE was brought under control after gowns and gloves were worn in the care of these patients[102,113]. Gowns and gloves have been used together in other studies, in which the individual benefit of these components could not be determined[270,274].

It is often stated that use of gowns may lead to increased compliance with hand washing by acting as a reminder. This has not been the case in studies in a pediatric ICU, where compliance was 31% when gowns were used and 30% when they were not[284], and in a neonatal ICU, where compliance when gowns were and were not used was 18% and 25% respectively[282].

D. Masks, eye protection

In UP, BSI and SP, the need for masks and eye protection during routine patient care depends on the task performed, i.e. whether it involves activities that are likely to generate splashes or sprays of blood, body fluids, secretions or excretions.

Masks are also worn to protect the HCW from acquisition of infections transmitted by large droplets. Surgical masks are considered adequate for this purpose[14]. It appears logical to use a mask when within 1 metre of a coughing patient[186]. However, use of masks and gowns for patients with respiratory illnesses was found not to reduce infection rates in HCWs or patients[287,288], probably because of acquisition on hands and eye inoculation[54,287]. Eye protection needs to be considered with certain organisms transmitted by large droplets. Eye protection by face shields or goggles has been shown to prevent RSV infection in HCWs[289,290]. Reduction of RSV transmission to HCWs wearing gloves, but not masks or eye protection, may have been because HCWs were less likely to touch their noses or eyes with gloved hands[274].

Surgical masks may not be sufficient to prevent inhalation of small droplet nuclei, although this concern is based on theory and not documentation of failure[14]. For airborne infections, special masks with high filtration capacity and good fit (referred to as dust-mist, dust-fume-mist, or high-efficiency particulate air filter respirators) and known to meet specific performance criteria are recommended[14,20].

E. Accommodation

Ideally, hospitals would accommodate all patients in single rooms to provide privacy for patient and family; this would facilitate infection control activities. In reality, numbers of single rooms in existing heath care facilities are limited, and most patient rooms and bathrooms must be shared. Critical care areas are frequently large open units or are divided into cubicles without doors.

Single rooms may reduce opportunities for direct and indirect contact and droplet transmission when the source patient has poor hygiene, contaminates the environment, or cannot be expected to comply with infection control measures because of age or altered mental status. Use of single rooms should facilitate application of additional precautions, including compliance by visitors. It is often assumed that HCW compliance with infection control precautions will be better when patients are in single rooms, although this was not the case in one ICU study in which hand washing compliance was not higher and infection rates were not lower with single rooms[239]. However, the opportunity for cross transmission between patients either directly or indirectly is theoretically reduced when patients are in single rooms. In a more recent ICU

study, nosocomial pneumonia rates were reduced in association with conversion of open units to single rooms[291]. Transmission of specific bacteria to the urine of patients with urinary catheters occurred three times more frequently if the patients shared a room[189]. In an outbreak of *C. difficile*, nosocomial acquisition occurred more frequently and more rapidly in patients exposed to an infected roommate[282]. Rates of nosocomial viral respiratory tract infections decreased in a pediatric hospital after transfer to a new facility where single rooms replaced rooms with multiple beds[292].

Assignment of patients known to be infected with the same organism to the same room, or grouping (cohorting) of infected and noninfected patients in separate wards or areas has been successful in controlling transmission of some infections[60,116,132,135,293-296]. However, information on specific microbial etiology is rarely available on admission. During community outbreaks of respiratory tract infections, rapid antigen testing prior to admission may aid in the placement of children[293,297]. Cohorting of HCWs as well as patients has been employed to control some hospital outbreaks[96,294,298] but is not always feasible and may be counterproductive if it results in inadequate staffing[298].

Previous Health Canada and current CDC guidelines recommend single rooms for many infections for which physical separation of patients is desirable or contamination of the immediate patient care environment is of concern, but for which special air handling is not required. Few hospitals have sufficient single rooms for use in all such indications. Two studies in Canadian pediatric hospitals showed a need for isolation for 15.3% of patient-days[299] or 13.5% of patients[300]. At times of the year when community outbreaks of viral infections occur the need is much higher[299]. Single room accommodation may be a difficulty for some long term care facilities where numbers of single rooms are limited[195].

Single room accommodation for infections that are not airborne may not be appropriate or necessary for newborns or young infants who are confined to an incubator or crib. The American Academy of Pediatrics suggests that separate isolation rooms are not necessary for newborn infants if the infection is not transmitted by the airborne route, there is a 1 to 2 metre aisle or area between newborn stations, sufficient sinks are available for hand washing, and continuing instruction is given to personnel about the modes of transmission of infections[45].

Previous recommendations to use single rooms "if available" for most patients with transmissible infections are not helpful. Criteria are needed for establishing priority for use of available single rooms, based on relative risks of transmission with different diseases and with different patient characteristics. The reality is that many patients requiring additional precautions will be cared for in rooms shared with appropriately selected room-mates. Problems to be addressed with shared rooms include how to delineate the boundary of the potentially contaminated patient area[186], risks from sharing of sinks and toilets, and controls on the activities of the room-mates and their visitors.

Single rooms with negative pressure ventilation should be used for patients with known or suspected airborne infections. Placing such patients in appropriate rooms may be challenging. In 1993, only a small number of acute care hospitals in Canada reported that they had an appropriate room for treating individuals requiring airborne precautions[301]. Again, if the numbers of such rooms are limited, priorities for their use need to be set. Appropriate isolation rooms are especially important for tuberculosis. For measles and varicella, risk of transmission may be assessed in relation to the presence of non-immune patients or health care personnel.

PART B.

RECOMMENDATIONS AND TOOLS

The term "Routine Practices" was chosen to emphasize that this is the level of care that should be provided for all patients.

For acute care settings the recommendations for "Routine Practices" do not differ in principle from the "Standard Precautions" published by the CDC in 1996; however, more details have been included in this document. Acute care centres that have already adopted "Standard Precautions" may choose to continue to use that terminology, and may wish to consult this guideline for details.

The CDC guideline was written for acute care centres and was not intended for use in other health care settings. "Standard Precautions" as recommended by CDC are inappropriate for other settings. This document provides recommendations for "Routine Practices" that are specific to long term care, ambulatory care and home care settings.

Appendix 1 describes the classification system used for these recommendations. Appendix II is a glossary of terms.

I. Recommendations for Acute Care Facilities

A. Routine practices for acute care facilities

This section recommends practices for the routine care of all patients, and incorporates previous precautions against bloodborne pathogens (Universal Precautions)[21].

Recent experience with ARO and with molecular subtyping of organisms usually considered to be normal flora has taught us that nosocomial colonization of hospitalized patients is a more frequent occurrence than was previously recognized[302,303]. Transmission of ARO or specific clonal subtypes may be considered a marker for the degree of patient contamination with the flora of other patients. Routine practices in acute care settings need to be adequate to prevent, or at least minimize, such transmission, and these guidelines attempt to address this need.

1. Hand Washing/Hand Antisepsis

a. Hands must be washed[231,249]

– after any direct contact with a patient, before contact with the next patient. Direct contact refers to hand contact with the patient's skin.

Special considerations: The need for hand washing after casual contact unrelated to patient care should be judged on an individual basis[a]

before any contact with immunocompromised or ICU patients

before performing invasive procedures

after contact with blood, body fluids, secretions and excretions and exudates from wounds

after contact with items known or considered likely to be contaminated with blood, body fluids, secretions, or excretions (e.g. bedpans, urinals, wound dressings)

immediately after removing gloves[268]

between certain procedures on the same patient where soiling of hands is likely, to avoid cross-contamination of body sites[258,277]

before preparing, handling, serving or eating food and before feeding a patient

---

a The line between casual contact, such as a handshake or holding the hand of a patient, and patient care is difficult to define. For casual or social contact that involves direct contact between the skin of the HCW and the patient, consider the likelihood of the patient's skin being heavily colonized or colonized with significant organisms, the extent of the contact (e.g. handshake, hug, vs holding patient for prolonged period), and whether or not the patient is immunocompromised.

when hands are visibly soiled
after personal use of toilet or wiping nose. **AII**[a]

b. Patients and family members should be instructed in proper hand washing. **BIII**

c. The patient's hands should be washed before eating, after toileting and when soiled. **BIII**

d. Plain soap may be used for routine hand washing[234,261]. **BII**

e. Hand antisepsis with an antiseptic soap or hand rinse is indicated[233,234]
before performing invasive procedures
before contact with immunocompromised patients and patients with extensive skin damage
before contact with percutaneously implanted devices. **BIII**

f. Waterless antiseptic hand rinses are superior to soap and water in reducing hand contamination[258-260,265] and should be made available as an alternative to hand washing. Antiseptic hand rinses are especially useful when time for hand washing or access to sinks is limited. **AI**

When there is visible soiling, hands should be washed with soap and water before using waterless antiseptic hand rinses. If soap and water are unavailable, cleanse hands first with detergent-containing towelettes[233]. **BIII**

g. Health care workers can reduce the frequency of hand washing required by minimizing *unnecessary* direct contacts with patients and their immediate environments. This can be accomplished by organization of care activities and avoiding actions such as leaning on bedrails. **BIII**

h. Hand washing sinks should be in sufficient numbers and placed so as to be readily accessible[237,252]. **BII**

For further information and recommendations on hand washing refer to *Infection Control Guidelines: Hand Washing, Cleaning, Disinfection and Sterilization in Health Care*[232].

---

a See Appendix 1 for the explanation of these recommendation grades.

2. Gloves

a. Gloves should be used as an additional measure, not as a substitute for hand washing[267,268]. **BII**

b. Gloves are not required for routine patient care activities in which contact is limited to a patient's intact skin. **BIII**

c. Gloves may not be needed for routine diaper changes if the procedure can be done without contaminating the hands with stool or urine. **C**

d. Clean, non-sterile gloves should be worn[21,108,272,304-306]
for contact with blood, body fluids, secretions and excretions, mucous membranes, draining wounds or non-intact skin (open skin lesions or exudative rash)
for handling items visibly soiled with blood, body fluids, secretions or excretions when the health care worker has open skin lesions on the hands. **AII**

e. When indicated, gloves should be put on directly before contact with the patient or just before the task or procedure requiring gloves[178, 276, 277]. **AII**

f. Gloves should be changed between care activities and procedures with the same patient after contact with materials that may contain high concentrations of microorganisms[268,277], e.g. after handling an indwelling urinary catheter or suctioning an endotracheal tube. **BIII**

g. Gloves should be removed immediately after completion of care or a specific task, at point of use and before touching clean environmental surfaces[178,276,277]. **AIII**

h. Hands should be washed immediately after removing gloves[267,268]. **AII**

i. Single-use disposable gloves should not be reused or washed[267]. **AII**

For further information and recommendations on glove use, refer to *Infection Control Guidelines: Hand Washing, Cleaning, Disinfection and Sterilization in Health Care*[232] and *Infection Control Guidelines: Preventing the Transmission of Bloodborne Pathogens in Health Care and Public Services Settings*[21].

3. Mask, Eye Protection, Face Shield

Masks and eye protection or face shields should be worn where appropriate to protect the mucous membranes of the eyes, nose and mouth during procedures and patient care activities likely to generate splashes or sprays of blood, body fluids, secretions or excretions[21,304,307]. **BIII**

4. Gowns

a. The routine use of gowns is not recommended[271,281-286]. **AI**

b. Gowns should be used to protect uncovered skin and prevent soiling of clothing during procedures and patient care activities likely to generate splashes or sprays of blood, body fluids, secretions, or excretions[21,307]. **BIII**

5. Accommodation

a. Generally, single rooms are not required for routine patient care[239,291,292]. **BIII**

b. In the acute care setting, patients who visibly soil the environment or for whom appropriate hygiene cannot be maintained should be placed in single rooms with dedicated toileting facilities. This includes mobile patients with fecal incontinence if stools cannot be contained in diapers, and patients with draining wounds who do not keep their dressings in place[106,117,141]. **BIII**

c. Single rooms are not required for children in diapers unless they have uncontained diarrhea and cannot be confined to their designated bed space[46]. **BIII**

6. Patient Care Equipment

a. Where possible, dedicated patient care equipment that will not be shared between patients should be considered for ICU and other high risk areas[131,180]. **BIII**

b. Reusable equipment that has been in direct contact with the patient should be cleaned and reprocessed before use in the care of another patient[120,121,176,178,179,184,185]. Items that are routinely shared should be cleaned between patients. A routine cleaning schedule should be established and monitored for items that are in contact only with intact skin, if cleaning between patients is not feasible. **BIII**

c. Equipment that is visibly soiled should be cleaned. **BIII**

d. Commodes, like toilets, should be cleaned regularly and when soiled. Bedpans should be reserved for use by a single patient and labelled appropriately. **BIII**

e. Procedures should be established for assigning responsibility and accountability for routine cleaning of all patient care equipment[308-311]. **BIII**

f. Soiled patient care equipment should be handled in a manner that prevents exposure of skin and mucous membranes and contamination of clothing and the environment. **BIII**

g. Used needles and other sharp instruments should be handled with care to avoid injuries during disposal or re-processing. Used sharp items should be disposed of immediately in designated puncture-resistant containers located in the area where the items were used[8,21,312]. **AIII**

h. Mouthpieces, resuscitation bags, or other ventilation devices should be provided for use in hospital areas where the need to resuscitate is likely to occur[8,21]. **BIII**

i. Personal care supplies (e.g. lotions, creams, soaps) should not be shared between patients. **BIII**

For detailed information and recommendations regarding cleaning, disinfection and sterilization of patient care equipment, housekeeping, laundry and waste management, refer to *Infection Control Guidelines: Hand Washing, Cleaning, Disinfection and Sterilization in Health Care*[232].

7. Environmental Control

Procedures should be established for routine care, cleaning and appropriate disinfection of patient furniture and environmental surfaces. **BIII**

For recommendations regarding housekeeping, handling of soiled linen, waste and other items refer to Health Canada *Infection Control Guidelines: Hand Washing, Cleaning, Disinfection, and Sterilization in Health Care*[232] and *Preventing the Transmission of Bloodborne Pathogens in Health Care and Public Services Settings*[21].

B. Additional precautions for acute care facilities

Additional precautions, as well as routine practices, are necessary for certain pathogens or clinical presentations. These precautions are based on method of transmission and are necessary for infections transmitted by the airborne or large droplet routes. They may be indicated for patients with certain highly transmissible or epidemiologically important microorganisms transmitted by direct or indirect contact.

Additional precautions should be taken not only when these pathogens are identified but also empirically for clinical syndromes in which the pathogens are likely causes, until the specific etiology is known.

The following factors must be considered:

Patients with identical symptoms may be infected by different organisms with different routes of transmission. For example, acute respiratory infections may be spread by large droplets alone (pertussis) or large droplets and direct and indirect contact (respiratory

viruses). Transmission of meningitis may be by large droplet (meningococcus) or direct and indirect contact (enterovirus). More than one type of precaution may be required pending identification of specific microbial etiology.

Some microorganisms may be transmitted by more than one route, necessitating more than one type of transmission precaution, e.g. varicella (airborne and contact), RSV (droplet and contact).

It is left to individual institutions to determine how they wish to combine precautions — e.g. making a card for the combination or posting two cards.

Transportation services should have policies and procedures in place for transporting patients with transmissible infections. If any additional precautions are indicated during transport, the institution should inform the personnel transporting the patient which precautions are required.

1. Airborne Transmission Precautions

Airborne precautions should be taken for the conditions listed in Table 3.

See Tables 6 and 7 (Part B, Section VI.C.) for complete alphabetic lists by clinical presentation (Table 6) and by specific etiology (Table 7), showing the recommended precautions and the duration of precautions.

Specific recommendations

As well as routine practices, airborne precautions include the following.

1. *Accommodation*[69,70,73-76]

   Single room[a]

   Negative pressure in relation to surrounding areas[b]

   A minimum of 6-9 air exchanges per hour[c]

   Air discharged outside the building and away from intake ducts, or through a high-efficiency filter if recirculated

   Door kept closed whether or not patient is in the room

   After discharge door kept closed until sufficient time has elapsed to allow removal of airborne organisms

   Patient confined to room

   Room should have toilet, hand washing and bathing facilities. **All**

---

a Patients known to be infected with the same virus (measles or varicella) may share a room. Patients with tuberculosis should not share, as strains and levels of infectivity may be different.

b An anteroom may assist in maintaining inward directional air flow but is not essential.

c Health Canada considered 6-9 exchanges per hour adequate for patients with tuberculosis[278]. CDC recommends 6-12[14].

TABLE 3. Airborne Transmission Precautions

AIRBORNE TRANSMISSION PRECAUTIONS SHOULD BE TAKEN FOR:

Clinical presentation

Suspected infectious pulmonary or laryngeal tuberculosis[a,c] (cough, fever, pulmonary infiltrates in a patient at risk for tuberculosis)

Maculopapular rash with coryza and fever until measles (rubeola) ruled out

Vesicular rash compatible with varicella or disseminated zoster until these are ruled out (contact precautions as well)

Hemorrhagic fever with pneumonia, acquired in appropriate endemic area (contact precautions as well)[b]

Specific etiology

Infectious forms of tuberculosis, pulmonary or laryngeal[a,c]

Measles (rubeola)

Nonimmune measles contact in infectious stage of incubation period (from 5 days after the first to 21 days after the last day of exposure)

Varicella (contact precautions as well)

Zoster: disseminated (contact precautions as well)

Zoster: extensive, localized zoster that cannot be covered, in pediatric settings or settings where there are susceptible immunocompromised patients (contact precautions as well)

Zoster: localized, in immunocompromised patient (even if covered) until the patient has received 24 hours of antiviral treatment (contact precautions as well); after this, as for zoster in an immunocompetent host

Nonimmune varicella or zoster contact in infectious stage of incubation period (from 8 days after the first to 21 days after the last day of exposure; 28 days if given varicella-zoster immune globulin)

Lassa, Ebola, Marburg, and other hemorrhagic fevers with pneumonia (contact precautions as well)[b]

---

a Refer to Health Canada Guidelines for preventing the transmission of tuberculosis in Canadian health care facilities and other institutional settings[20].

b Local public health authorities or medical officer of health and LCDC (Telephone 613-957-0326) should be notified immediately. Refer to Health Canada *Canadian Contingency Plan for Viral Hemorrhagic Fevers and Other Related Diseases*[22]

c Special considerations for pediatrics:
- Young children with tuberculosis are rarely infectious and rarely need additional precautions, as they usually do not cough and usually do not have cavitary disease. If in doubt, consult an expert in tuberculosis management.
- Nosocomial transmissions in pediatric settings have been from parents and visitors with unrecognized infectious tuberculosis[34a].
Close contacts of children with primary tuberculosis should be assessed for cough and if coughing, they should not visit until infectious tuberculosis has been ruled out. If visiting is unavoidable (e.g. parent), the visitor should be considered potentially infectious, be subject to airborne precautions with the child, and should wear a surgical mask when out of the room.

Special considerations for accommodation:

Centres that do not have appropriately ventilated rooms should transfer patients with infectious forms of tuberculosis to institutions with such accommodation. Plans should be coordinated in advance with other institutions[20].

For measles or varicella, institutions without negative pressure rooms and where transfer is not a feasible option may consider using a single room with door closed, given that most individuals are immune and post exposure prophylaxis is possible. Such patients should be accommodated on wards where there are no susceptible, immunocompromised patients.

If numbers of negative pressure rooms are limited, priority for use of such rooms should be set according to the impact of potential airborne transmission in that specific institution (i.e., infectious tuberculosis > measles > varicella > disseminated zoster > extensive localized zoster).

2. *Personnel and visitors*[313-320]

All health care personnel should be immune to measles. For immunization recommendations refer to the *Canadian Immunization Guide*[321] and *Occupational Health in Health Care Facilities*[322].

Personnel susceptible to measles should not enter the room of a patient with measles.

Varicella-susceptible personnel and visitors should not enter the room of a patient with varicella or disseminated zoster unless exceptional circumstances make this mandatory. **AIII**

3. *Masks*[20,323]

Special masks: high-efficiency dust/mist masks[a] should be available for all who enter the room of a patient with infectious tuberculosis, or for non-immune persons who absolutely must enter the room of a patient with varicella, disseminated zoster or measles. **BIII**

4. *Patient transport*

Patient should be out of the room for essential procedures only

Patient should wear surgical (procedure) mask during transport

Personnel in area to which patient is to be transported should be aware of precautions to follow. **BIII**

---

a Masks should filter particles one micron in size, have a 95% filter efficiency and provide a tight facial seal (less than 10% leak). Provided that an adequate facial seal is present, respirators that are NIOSH certified as N95, N99, N100, R95, R99, R100, P95, P99 or P100 meet or exceed the minimum recommendation. Other masks may meet these requirements. Check manufacturers' written specifications. See Health Canada *Guideline for preventing the transmission of tuberculosis in Canadian health care facilities and other institutional settings*[20] for further details.

5. *Patient and family teaching*

   Patients should understand the nature of their infectious disease and the precautions being used, as well as the prevention of transmission of disease to family and friends during their hospital stay and upon their return to the community. **BIII**

6. *Visitors*

   Visitors should talk with a nurse before entering the room and, if indicated, should be instructed in the appropriate use of a mask and other precautions. The number of visitors should be kept to a minimum. **BIII**

2. Droplet Transmission Precautions

Droplet precautions should be used for the conditions listed in Table 4.

Please note that precautions differ for pediatric and adult patients.

See Tables 6 and 7 (Part B, Section VI.C.) for complete alphabetic lists by clinical presentation (Table 6) and by specific etiology (Table 7), showing the recommended precautions and the duration of precautions.

Specific recommendations

As well as routine practices, droplet precautions include the following.

1. *Accommodation*

   Special considerations

   In adult acute care institutions, a single room is preferable, as it may be difficult to maintain the recommended 1 metre spatial separation between patients. Infections requiring droplet precautions occur rarely in hospitalized adults.

   In pediatric institutions, where large numbers of patients requiring droplet precautions are present simultaneously and single rooms may be in short supply, single room accommodation is frequently not possible. If room is to be shared, see below.

   i. Single room:

      Door may remain open.

      Single room should have toilet and hand washing facilities. **BIII**

   ii. Cohort:

      Patients known to be infected with the same organism (identified by culture or rapid antigen test) may be grouped together[293-295,325]. **BII**

TABLE 4. Droplet Transmission Precautions

DROPLET TRANSMISSION PRECAUTIONS SHOULD BE TAKEN FOR:		
Clinical presentation	**Pediatrics[a]**	**Adults**
All definite or possible respiratory tract infections until viral infection ruled out (use droplet plus contact precautions): Bronchiolitis Colds Croup Pneumonia Pharyngitis Asthma, febrile, < 2 years old	Yes	No (consider in an outbreak situation)
Paroxysmal cough or suspected pertussis	Yes	Yes
Cellulitis in child < 5 years old (without portal of entry)[b] Epiglottitis[b] Periorbital cellulitis in child < 5 years old (without portal of entry)[b] Septic arthritis in child < 5 years old (without portal of entry)[b]	Yes	No
Meningitis (use droplet plus contact for pediatrics)	Yes	If meningococcal possible
Petechial or ecchymotic rash with fever (etiology unknown or suspected meningococcemia)	Yes	If suspected meningococcemia
Suspected hemorrhagic fever without pneumonia, acquired in appropriate endemic area[c] (contact precautions as well; use airborne if pneumonia)	Yes	Yes
Specific etiology		
Diphtheria, pharyngeal (*C. diphtheriae*)	Yes	Yes
H. influenzae type b invasive infections (until 24 hours of appropriate antibiotic received)	Yes	No
Mumps Nonimmune mumps contact in potentially infectious stage of incubation period (10 days after first contact through 26 days after last)	Yes Yes	Yes Yes
N. meningitidis invasive infections (until 24 hours of appropriate antibiotic received)	Yes	Yes
Parvovirus B19 - chronic infection in immunocompromised patient or transient aplastic crisis in patient with hemoglobinopathy[284]	Yes	Yes

DROPLET TRANSMISSION PRECAUTIONS SHOULD BE TAKEN FOR:		
Specific etiology *(cont'd)*	**Pediatrics**[a]	**Adults**
Pertussis *(B. pertussis)* (until 5 days of appropriate antibiotic received)	Yes	Yes
Plague, pneumonic (*Yersinia pestis*)	Yes	Yes
Rubella Congenital rubella (contact precautions as well) Nonimmune rubella contact in potentially infectious stage of incubation period (7 days after first contact through 21 days after last)	Yes Yes Yes	Yes Yes
Streptococcus group A invasive disease (until 24 hours of appropriate antibiotic received) *Streptococcus* group A pharyngitis, pneumonia, scarlet fever (until 24 hours of appropriate antibiotic received)	Yes Yes	Yes No
Viral respiratory tract infections (use droplet plus contact precautions): Adenovirus Parainfluenza virus Rhinovirus RSV	Yes	No (consider in an outbreak situation)
Influenza (airborne precautions may be considered in certain circumstances, see below[d])	Yes	Optional[e]
Lassa, Ebola, Marburg, and other hemorrhagic fevers without pneumonia[c] (contact precautions as well; if pneumonia, use airborne and contact precautions)	Yes	Yes

a. Use pediatric precautions for children who are incontinent or too immature to be able to comply with hand washing requirements; appropriate handling and disposal of respiratory secretions, purulent discharges and skin exudates; and maintenance of dressings in place. For older children who are continent and able to comply with precautions for respiratory secretions and skin lesions, precautions recommended for adults may be used.

b. These recommendations are for possible *Haemophilus influenzae* type b (HIB) infection, and are not necessary if the child has received HIB vaccine.

c. Local public health authorities or medical officer of health and LCDC (Telephone 613-957-0326) should be notified immediately. Refer to Health Canada *Canadian contingency plan for viral hemorrhagic fevers and other related diseases*[22].

d. Although it remains controversial whether influenza can be transmitted by the airborne route[14,83] practical considerations usually make it impossible to use airborne precautions for influenza. Influenza may be indistinguishable from several other acute febrile illnesses and clinical diagnosis can only be made in the appropriate epidemiologic context. Specific diagnosis by viral culture or serology is slow. Also, influenza epidemics tend to be explosive and few institutions have sufficient numbers of negative pressure rooms to accommodate all patients with known or suspected influenza during an outbreak.
Ensuring that all high-risk persons receive influenza vaccine is a more effective strategy for influenza control than attempting airborne precautions. However, until further information is available it may be prudent to use negative pressure rooms for patients with suspected influenza who must be accommodated in high risk areas such as oncology or bone marrow transplant units[61].

e. Although it is thought that influenza is transmitted by large droplet and contact routes, it is controversial as to whether or not additional precautions are indicated for adults with influenza.

iii. Shared room:

Maintain spatial separation of at least 1 metre between infected patient and other patients and their visitors.

Room-mates and all visitors must be aware of precautions to follow.

Select room-mates: Room-mates should be selected for their ability and that of their visitors to comply with precautions. With respiratory viruses, room-mates should not be at high risk of complications should they acquire the infection (e.g. chronic lung disease, severe congenital heart disease, immunodeficiency).

For newborn nurseries, a single room is not necessary if there is a 1-2 metre aisle between infant stations[46].

Single room indicated if these conditions are not achievable. **BIII**

2. *Masks*

A surgical/procedure mask should be worn by all HCWs if within 1 metre of patient[49,50], with the following exceptions:

For care of children with symptoms of acute respiratory viral infection, masks should be worn by HCWs if within 1 metre of patient who is coughing or if performing procedures that may result in coughing[55,56,59,294].

For care of patients with rubella or mumps, a mask is not needed if the HCW is immune. Nonimmune personnel should enter the room only if it is absolutely necessary, and should wear masks. **BIII**

3. *Eye protection (glasses, goggles, face shields)*

Some viruses causing acute respiratory tract infections may be transmitted by direct deposition or inoculation of large droplets onto the conjunctiva[55-57,289,290]. Eye protection may be indicated for care of children with symptoms of acute respiratory infection if the HCW is within 1 metre of a coughing patient or is performing procedures that may result in coughing. **BII**

For other infections transmitted by large droplets, eye protection should be worn as per routine patient care practices.

4. *Patient transport*

Patient should be out of the room for essential procedures only.

Patient should wear surgical mask during transport.

Personnel in area to which patient is to be transported should be aware of precautions to follow. **BIII**

5. *Patient and family teaching*

Patients should understand the nature of their infectious disease and the precautions being used, as well as the prevention of transmission of disease to family and friends during their hospital stay and upon their return to the community. **BIII**

6. *Visitors*

Visitors should talk with a nurse before entering the room and, if indicated, should be instructed in the appropriate use of a mask and other precautions. The number of visitors should be kept to a minimum. **BIII**

In the case of patients with acute viral respiratory infections, masks are not mandatory for visitors, for whom wearing a mask for an extended period of time may be impractical. The risk to the health of the visitor should be evaluated.

For patients with rubella or mumps, a mask is not needed if the visitor is immune. Nonimmune visitors should enter the room only if it is absolutely necessary, and should wear appropriate masks.

For suspected or confirmed *H. influenzae* type b infection, visitors need wear masks only if they will have extensive close contact with nonimmune infants.

For all other infections transmitted by large droplets, masks should be worn by all persons coming within 1 metre of the patient. **BIII**

3. Contact Transmission Precautions

Additional precautions may be indicated for certain organisms when routine practices are not sufficient to control transmission, for instance,

- if the organism has a low infective dose
- if the organism may be transmitted from the source patient's intact skin
- if there is potential for widespread environmental contamination.

Contact precautions should be used for the conditions listed in Table 5.

Please note that precautions differ for pediatric and adult patients.

See Tables 6 and 7 (Part B, Section VI.C.) for complete alphabetic lists by clinical presentation (Table 6) and by specific etiology (Table 7), showing the recommended precautions and duration of precautions.

Specific recommendations

Note that these precautions differ from previous contact precautions in that use of gloves is now recommended for entering the patient's room.

TABLE 5. Contact Transmission Precautions

CONTACT TRANSMISSION PRECAUTIONS SHOULD BE USED FOR:		
Clinical presentation	**Pediatrics[a]**	**Adults**
Diarrhea until infectious cause ruled out Diarrhea of likely infectious cause if uncontrolled (incontinent patient, stool cannot be contained in diapers and patient cannot be confined to bed)	Yes Yes	No Yes
Diarrhea in patients with suspected *C. difficile* infection	Yes	Yes
Major burn wound infection	Yes	Yes
Extensive desquamating skin disorder with known or suspected infection or significant colonization	Yes	Yes
Skin rash compatible with scabies - selected cases (refer to Table 7)	Yes	Yes
Draining infected wound or abscess if drainage cannot be contained by dressing	Yes	Yes
Vesicular rash compatible with varicella or disseminated zoster (use airborne plus contact)	Yes	Yes
Hemorrhagic fever, acquired in appropriate endemic area (use airborne or droplet as well)[b]	Yes	Yes
Meningitis (use droplet as well)	Yes	No
All definite or possible respiratory tract infections until viral infection ruled out (use droplet plus contact precautions): Bronchiolitis Colds Croup Pneumonia Pharyngitis Asthma, febrile, < 2 years old	Yes	No
Specific etiology		
Diarrhea due to: *Campylobacter* Pathogenic strains of *E.coli* *Giardia* Rotavirus *Salmonella* *Shigella* *Yersinia*	Yes	No (unless incontinent patient, stool cannot be contained in diapers, and patient cannot be confined to bed)
C. difficile infection with diarrhea	Yes	Yes
Enteroviral infections	Yes	No
Hepatitis A, E	Yes	No
Herpes simplex virus: neonatal or disseminated mucocutaneous	Yes	No
Scabies - selected cases (refer to Table 7)	Yes	Yes

CONTACT TRANSMISSION PRECAUTIONS SHOULD BE USED FOR:		
Specific etiology *(cont'd)*	**Pediatrics**[a]	**Adults**
Varicella (airborne precautions as well) Zoster: disseminated (airborne precautions as well) Zoster: extensive, localized zoster that cannot be covered, in pediatric settings or settings where there are susceptible immunocompromised patients (airborne precautions as well) Zoster: localized, in immunocompromised patient (even if covered) until the patient has received 24 hours of antiviral treatment (airborne precautions as well); after this, as for zoster in an immunocompetent host.	Yes	Yes
Congenital rubella (droplet precautions as well)	Yes	
Viral respiratory tract infections (use droplet plus contact precautions): Adenovirus Parainfluenza virus Rhinovirus RSV Influenza	Yes Yes	No Optional[c]
Lassa, Ebola, Marburg, and other hemorrhagic fevers (use airborne or droplet precautions as well)[b]	Yes	Yes
Antimicrobial-resistant organisms (see Part B, section I.B.4)	Yes	Yes

a Use pediatric precautions for children who are incontinent or too immature to be able to comply with hand washing requirements; appropriate handling and disposal of respiratory secretions, purulent discharges and skin exudates; and maintenance of dressings in place. For older children who are continent and able to comply with precautions for respiratory secretions and skin lesions, precautions recommended for adults may be used.

b Local public health authorities or medical officer of health and LCDC (Telephone 613-957-0326) should be notified immediately. Refer to Health Canada *Canadian contingency plan for viral hemorrhagic fevers and other related diseases*[223].

c Although it is thought that influenza is transmitted by large droplet and contact routes, it is controversial as to whether or not additional precautions are indicated for adults with influenza.

As well as routine practices, contact precautions include the following.

1. *Accommodation*

   Special considerations

   In adult acute care institutions, a single room is preferable, as it may be difficult to maintain the recommended 1 metre physical separation between patients.

   In pediatric institutions where large numbers of patients requiring contact precautions are present simultaneously and where single rooms may be in short supply, single room accommodation is frequently not possible. If a room is to be shared, see below.

   i. Single room[95,262]:

      Door may remain open.

      Single room should have toilet and hand washing facilities. **BIII**

   ii. Cohort:

      Patients known to be infected with the same organism (identified by culture or rapid antigen test) may be grouped together unless acquisition of different strains of the microorganism is a concern[42,95,116,132,135,293-296,325]. **BII**

   iii. Shared room:

      Maintain spatial separation of at least 1 metre between infected or colonized patient and other patients and their visitors.

      Room-mates and all visitors must be aware of precautions to follow.

      Select room-mates:

      • Room-mates should be selected for their ability and that of their visitors to comply with precautions.

      • Room-mates should not be at high risk of serious disease if transmission occurs.

      For newborn nurseries, a single room is not necessary if there is a 1-2 metre aisle between infant stations[48].

   Single room indicated if these conditions are not achievable. **BIII**

2. *Gloves*[131,137,273-275,294,295]

   Gloves should be worn when entering the room or patient's designated bed space in shared room. **AII**

   Gloves should be removed before leaving the room or the patient's dedicated bed space[178,276,277]. **AIII**

3. *Gowns*[113,141,274,294,295]

   Gowns should be worn if clothing or forearms will have direct contact with the patient.

   Gowns should be worn if it is anticipated that clothing or forearms will be in direct contact with frequently touched environmental surfaces or objects and

there is increased risk of the environment being contaminated (incontinent patient; diarrhea; or drainage from wound, colostomy or ileostomy not contained by dressing).

Gown should be removed before leaving the room. **BII**

4. *Hand washing*

   Remove gown and gloves and wash hands with antiseptic or use antiseptic hand rinse before leaving the room[95,259,260,262,267,268]. When there is visible soiling, hands should be washed with soap and water before using waterless antiseptic hand rinses.

   After hand washing, take care not to contaminate hands before leaving the room[262]. **AII**

5. *Equipment and environment*[51-53,102,116,117,120-122,141,172,174,176,178,179,326,327]

   Patient-care equipment (e.g. thermometer, blood pressure cuff, pulse oximeter) should be dedicated to the use of that patient and should be cleaned and disinfected before reuse with another patient. Toys and personal effects should not be shared with other patients.

   The patient chart should not be taken into the room.

   All horizontal and frequently touched surfaces should be cleaned daily and when soiled.

   Special cleaning procedures may be required in outbreak situations[116,188,328]. **BIII**

6. *Patient transport*

   Patient should be out of the room for essential purposes only.

   Maintain precautions during transport to minimize risk of transmission to other patients and contamination of environmental surfaces or objects.

   Personnel in area to which patient is to be transported should be aware of precautions to follow. **BIII**

7. *Patient and family teaching*

   Patients should understand the nature of their infectious disease and the precautions being used, as well as the prevention of transmission of disease to family and friends during their hospital stay and upon their return to the community. **BIII**

8. *Visitors*

   Visitors should talk with a nurse before entering the room and, if indicated, should be instructed in the appropriate use of gown, gloves or other special precautions. The risk to the health of the visitor, and the risk of the visitor transmitting should be evaluated. The number of visitors should be kept to a minimum. **BIII**

4. Antimicrobial Resistant Organisms (ARO): Special Considerations

Routine practices and contact precautions are recommended for infection or colonization with organisms such as MRSA, VRE, or other organisms resistant to a wide spectrum of antibiotics (as determined by the infection control service of the institution). In addition there are some further considerations:

Some institutions may choose to include precautions for persons at risk of colonization pending screening results[14,34,329]. C

Whether gloves are needed for everyone entering the room of a patient with asymptomatic colonization with MRSA is controversial. C

Data are inconclusive on the need for gowns for all persons entering the room of a patient with MRSA[42,100,127,129,132,134,136] or VRE[102,113,116,133, 330]. This may be considered if transmission is occurring in the facility. C

Data are inconclusive on the need for masks for persons caring for patients with MRSA[42,95,112,127,129,132,134-136,139,331]. Masks may protect the HCW from nasal colonization. Masks should be considered if the rate of HCW acquisition of nasal colonization with MRSA is high, or if a patient with MRSA nasal or respiratory colonization has a superimposed viral respiratory tract infection[332]. C

Remove gloves, gown and mask before leaving patient's room. C

For some situations in which environmental contamination is profuse, increased cleaning frequencies may be considered. C

In outbreaks, cleaning and disinfection with a disinfectant that has documented efficacy against the specific organism may be required. C

There are insufficient data at present on which to base recommendations for discontinuation of precautions for patients colonized with ARO. Decisions will need to be made locally taking into consideration the specific microorganism, the patient population and local experience with duration of colonization. These policies should be updated as data become available. C

Knowledge about emergence of ARO, means of transmission, and the characteristics of patients or activities associated with transmission is evolving, and recommendations will need to be updated as further information becomes available. Conflicting recommendations reflect this evolution.

Precautions for *S. aureus* of intermediate or high level resistance to vancomycin (minimum inhibitory concentration [MIC] ≥ 4 µg/mL)

Because of the recent emergence of this organism with its potential for serious public health consequences and the lack of epidemiologic data, a more extensive form of contact precautions is advised as an interim measure.

Local public health authorities or the medical officer of health and LCDC (telephone: 613-957-0326) should be notified immediately.

Precautions:

- Minimize the numbers of persons who enter the room.
- Assign a specific HCW to provide one-to-one care or cohort patients and HCW.
- Inform all personnel providing direct patient care of specific epidemiologic implications of this microorganism and of the necessary precautions.
- Use a single room.
- Require gloves, gown, and mask to be worn by all who enter the room.
- Remove gloves, gown, and mask before leaving the room.
- Hand wash with antiseptic soap after removing gloves.
- Monitor compliance with and efficacy of the recommended precautions.
- Clean and disinfect all equipment that may have been in contact with the patient.
- Avoid transfer within and between institutions if possible; if transfer unavoidable, advise the receiving unit or institution of the precautions.

For further information on antimicrobial resistant organisms, refer to *Controlling Antimicrobial Resistance: An Action Plan for Canadians*[94] and *Infection Control Guidelines: Preventing the Spread of Vancomycin-Resistant Enterococci (VRE) in Canada*[23].

II. Recommendations for Long Term Care Facilities

A. Routine practices for long term care facilities

This section recommends practices for the routine care of all residents, and incorporates previous precautions against bloodborne pathogens (Universal Precautions).

1. Hand Washing/Hand Antisepsis

a. Hands must be washed[26,231]

before providing care to a resident.

Special considerations: The need for hand washing after casual contact unrelated to health care should be judged on an individual basis[a]

before performing invasive procedures, e.g. insertion of urinary or intravenous catheters, tracheostomy care

after contact with blood, body fluids, secretions and excretions, draining wounds or non-intact skin

after contact with items known or considered likely to be contaminated with blood, body fluids, secretions or excretions, e.g. bedpans, urinals, wound dressings

immediately after removing gloves[268]

between certain procedures on the same resident where soiling of hands is likely, to avoid cross-contamination of body sites[258,277]

before preparing, handling, serving or eating food and before feeding a resident

when hands are visibly soiled

after personal use of toilet or wiping nose. **AII**

b. There should be provision for adequate hygiene and skin care for residents, as appropriate to their functional status, i.e. by instruction or physical assistance. Family members should be included in hand washing instructions[26]. **BIII**

---

a The line between casual contact, such as a handshake or holding a resident's hand, and health care is difficult to define. For casual or social contact that involves direct contact between the skin of the care giver and the resident, consider the likelihood of the resident's skin being contaminated or colonized with significant organisms, the extent of the contact (e.g. handshake, hug, vs holding resident for prolonged period), and whether or not the resident is immunocompromised.

c. The resident's hands should be washed before eating, after toileting and when soiled. **BIII**

d. Plain soap may be used for routine hand washing[234]. **BII**

e. Adequate supplies should be provided for HCW hand washing. These should be distinct from the personal supplies of the resident, e.g. wall-mounted liquid soap dispenser, paper towels[26]. **BIII**

f. For HCW hand washing, waterless antiseptic hand rinses are an alternative to soap and water, and are especially useful when time for hand washing or access to sinks is limited[233,258,259,265]. **AII**

When there is visible soiling, hands should be washed with soap and water before using waterless antiseptic hand rinses. If soap and water are unavailable, cleanse hands first with detergent-containing towelette[233]. **BIII**

g. Sinks should be in adequate numbers and accessible to facilitate staff, resident and visitor hand washing[26,252]. **BIII**

For further information and recommendations on hand washing refer to *Infection Control Guidelines: Hand Washing, Cleaning, Disinfection and Sterilization in Health Care*[232].

2. Gloves

a. Gloves are not required for routine resident care activities in which contact is limited to the resident's intact skin[159]. For example, gloves are not needed for feeding residents unless direct contact with mucous membranes or oral secretions will occur. **BIII**

b. Gloves should be used as an additional measure, not as a substitute for hand washing[267,268]. **BII**

c. Gloves may not be needed for routine changing of diapers or incontinence briefs if the procedure can be done without contaminating the hands with stool or urine. **C**

d. Clean, non-sterile gloves should be worn[21,272,304-306]

for contact with blood, body fluids, secretions and excretions, mucous membranes, draining wounds or non-intact skin (open skin lesions or exudative rash)

for handling items visibly soiled with blood, body fluids, secretions or excretions when the health care worker has open skin lesions on the hands. **AII**

e. When indicated, gloves should be put on directly before contact with the resident or before the procedure for which gloves are required[178,276,277]. **AII**

f. Gloves should be changed between care activities with the same resident after contact with materials that may contain high concentrations of microorganisms[268,277]. **BIII**

g. Gloves should be removed immediately after completion of a specific procedure or after care of the resident and discarded in the resident's room[178,276,277]. **AIII**

h. Hands should be washed immediately after removing gloves[267,268]. **AII**

i. Single-use disposable gloves should not be reused or washed[267]. **AII**

For further information and recommendations on glove use, refer to *Infection Control Guidelines: Hand Washing, Cleaning, Disinfection and Sterilization in Health Care*[232] and *Infection Control Guidelines: Preventing the Transmission of Bloodborne Pathogens in Health Care and Public Services Settings*[21].

3. Mask, Eye Protection, Face Shield

Masks and eye protection or face shields should be worn where appropriate to protect the mucous membranes of the eyes, nose and mouth during procedures and resident care activities likely to generate splashes or sprays of blood, body fluids, secretions, or excretions[21,304,307]. **BIII**

4. Gowns

a. The routine use of gowns is not recommended[271,281-286]. **AI**

b. Gowns should be used to protect uncovered skin and prevent soiling of clothing during procedures and resident care activities likely to generate splashes or sprays of blood, body fluids, secretions, or excretions[21,307]. **BIII**

5. Personal Care Supplies

Personal care supplies (e.g. lotions, creams, soaps, razors) should not be shared between residents. **BIII**

6. Health Care Equipment

a. Reusable equipment that has been in direct contact with the resident should be cleaned before use in the care of another resident. For items that are in contact only with intact skin, if cleaning between residents is not feasible, a routine cleaning schedule should be established and monitored[26]. **BIII**

b. Equipment that is visibly soiled should be cleaned. **BIII**

c. Commodes, like toilets, should be cleaned regularly and when soiled. Bedpans should be reserved for use by a single resident and labelled appropriately. **BIII**

d. Procedures should be established for assigning responsibility and accountability for routine cleaning of all health care equipment. **BIII**

e. Soiled health care equipment, e.g. bedpans, should be handled in a manner that prevents exposures to skin and mucous membranes and contamination of clothing and the environment. **BIII**

f. Used needles and other sharp instruments should be handled with care to avoid injuries during disposal or reprocessing. Used sharp items should be disposed of in designated puncture-resistant containers located in the area where the items were used[8,21,312]. **AIII**

g. Mouthpieces, resuscitation bags, or other ventilation devices should be provided for use in areas where the need to resuscitate is likely to occur[8,21]. **BIII**

For detailed information and recommendations regarding cleaning, disinfection and sterilization of equipment, housekeeping, laundry and waste management, refer to *Infection Control Guidelines: Hand Washing, Cleaning, Disinfection and Sterilization in Health Care*[232].

7. Environmental Control

Procedures should be established for routine care, cleaning and, where appropriate, disinfection of resident furniture and environmental surfaces. **BIII**

For recommendations regarding the handling of soiled linen, waste, and other items refer to Health Canada *Infection Control Guidelines: Hand Washing, Cleaning, Disinfection, and Sterilization in Health Care*[232] and *Preventing the Transmission of Bloodborne Pathogens in Health Care and Public Services Settings*[21].

B. Additional precautions for long term care facilities

Additional precautions, as well as routine practices, are necessary for certain pathogens or clinical presentations. These precautions are based on method of transmission and are necessary for infections transmitted by the airborne or large droplet routes. They may be indicated for residents with certain highly transmissible or epidemiologically important microorganisms transmitted by direct or indirect contact.

Resident and Family Teaching: This is an important aspect of resident care that should not be overlooked. Residents should understand the nature of their infectious disease and the

precautions being taken, as well as the prevention of transmission of disease to family and friends.

Visitors: Visitors should talk with a nurse before visiting the room of a resident for whom there are additional precautions and, if indicated, should be instructed in the appropriate use of gown, mask, gloves or other special precautions.

Transport: Transportation services should have policies and procedures in place for transporting residents with transmissible infections. If any additional precautions are indicated during transport, the facility should inform the personnel transporting the resident which precautions are required.

1. Airborne Transmission Precautions

(airborne precautions should be taken for the organisms listed in Table 3)

a. Tuberculosis[20,209,210,333]

1. Residents with newly diagnosed infectious tuberculosis (TB) should be managed according to the same policies and procedures as patients cared for in the acute care setting. **AIII**
2. Some long term care settings may have appropriate facilities for airborne precautions for TB. If not, transfer of the resident to a health care facility equipped to manage infectious TB should be arranged as soon as possible. **BIII**
3. If transfer is delayed or not possible the likelihood of transmission of TB may be reduced by the following:

   Place the resident in a single room with the door and window closed.

   Ensure that all persons entering the room wear an appropriate high efficiency dust/mist mask[a]

   Limit the number of people entering the room. Visits by children under 12 years of age should be prohibited because they are highly susceptible to infection with *M. tuberculosis*.

   Instruct HCWs, residents and visitors about the importance of adhering to airborne precautions for TB.

   The resident should be out of the room for essential purposes only, and should wear a surgical/procedure mask continuously when out of the room.

---

a Masks should filter particles one micron in size, have a 95% filter efficiency and provide a tight facial seal (less than 10% leak). Provided that an adequate facial seal is present, respirators that are NIOSH certified as N95, N99, N100, R95, R99, R100, P95, P99 or P100 meet or exceed the minimum recommendation. Other masks may meet these requirements. Check manufacturers' written specifications. See Health Canada *Guidelines for preventing the transmission of tuberculosis in Canadian health care facilities and other institutional settings*[333] for further details.

Discontinue airborne precautions only after the resident is no longer infectious. **BIII**

For further information refer to the Health Canada *Guidelines for Preventing the Transmission of Tuberculosis in Canadian Health Care Facilities and Other Institutional Settings*[20].

b. Varicella or disseminated herpes zoster

1. Precautions may not be indicated if all other residents and all HCWs are immune to varicella, and non-immune visitors and employees are restricted from entering the area. Otherwise, use airborne and contact precautions as for acute care facilities. It may be helpful to determine the immune status of residents at the time of admission. **BIII**

2. If negative pressure rooms are not available and transfer is not a feasible option, use a single room with door and windows closed. Infected residents should not be accommodated on units where there are susceptible immunocompromised residents.

   The resident should remain in the room until all lesions have crusted.

   Susceptible personnel and visitors should not enter the room. If exceptional circumstances make this necessary, an appropriate high efficiency dust/mist mask[a] must be worn.

   The resident should be out of the room for essential purposes only, unless it is established that all potential contacts are immune.

   The resident should wear a surgical/procedure mask and have skin lesions covered when out of the room. **BIII**

3. The immune status of exposed room-mates and other close contacts should be determined and, if they are susceptible, precautions should be taken from eight days after the first possible exposure until 21 days after the last exposure. Varicella-zoster immune globulin (VZIG) is recommended for exposed susceptible contacts at risk of severe disease, and precautions should be extended to 28 days after exposure. Place exposed susceptible contacts in single rooms or group them (cohort) until the incubation period is over. The doors and windows should be kept closed. **AIII**

c. Measles

1. Precautions may not be indicated if all other residents and all HCWs are immune to measles, and non-immune visitors and employees are prevented

---

a Masks should filter particles one micron in size, have a 95% filter efficiency and provide a tight facial seal (less than 10% leak). Provided that an adequate facial seal is present, respirators that are NIOSH certified as N95, N99, N100, R95, R99, R100, P95, P99 or P100 meet or exceed the minimum recommendation. Other masks may meet these requirements. Check manufacturer's written specifications. See Health Canada *Guideline for preventing the transmission of tuberculosis in Canadian health care facilities and other institutional settings*[20] for further details.

from entering the area. Otherwise, use airborne precautions as for acute care facilities. **BIII**

2. If negative pressure rooms are not available and transfer is not a feasible option, use a single room with door and windows closed. Infected residents should not be accommodated on units where there are susceptible immunocompromised residents.

   The resident should remain in the room until four days after onset of the rash.

   Susceptible personnel and visitors should not enter the room. If exceptional circumstances make this necessary, an appropriate high efficiency dust/mist mask[a] must be worn.

   The resident should be out of the room for essential purposes only, unless it is established that all other residents and all HCWs are immune to measles. The resident should wear a surgical/procedure mask when out of the room. **BIII**

3. The immune status of exposed room-mates and other close contacts should be determined. Susceptible contacts should receive prophylaxis with measles vaccine or immunoglobulin. Precautions should be taken for exposed susceptible contacts from five days after the first possible exposure until 21 days after the last exposure. Place susceptible contacts in single rooms or group them (cohort) until the incubation period is over. The doors and windows should be kept closed. **AIII**

2. Droplet Transmission Precautions

a. Viral respiratory tract infections[60,64,65,334,335]

1. When a resident has symptoms of an acute respiratory viral infection, consideration should be given to maintaining a 1 metre spatial separation from other residents and from visitors. **BIII**
2. Participation in group activities may need to be adjusted or restricted while the resident is symptomatic. **BIII**
3. Room-mates and visitors must be aware of precautions to follow. **BIII**
4. During an outbreak in a facility, consider restricting social activities to wards. **BIII**

---

a Masks should filter particles one micron in size, have a 95% filter efficiency and provide a tight facial seal (less than 10% leak). Provided that an adequate facial seal is present, respirators that are NIOSH certified as N95, N99, N100, R95, R99, R100, P95, P99 or P100 meet or exceed the minimum recommendation. Other masks may meet these requirements. Check manufacturers' written specifications. See Health Canada *Guidelines for preventing the transmission of tuberculosis in Canadian health care facilities and other institutional settings*[336] for further details.

5. Restrictions in the numbers of visitors may be advisable during a community outbreak of influenza. **BIII**

6. During an outbreak of influenza in a facility, consideration may be given to having HCWs wear a mask when within 1 metre of a symptomatic resident. The role of masks in the control of influenza outbreaks in long term care facilities has not been established. Use of gloves and hand washing after contact with the resident or with potentially contaminated surfaces and items may be more important[88]. **C**

b. Other infections transmitted by large droplets (Table 4 provides a list of organisms transmitted by droplets)

These are unusual events in long term care facilities and should be managed as in acute care facilities (Part B. Section I.B.2).

3. Contact Transmission Precautions

Additional precautions may be indicated for certain organisms if routine practices are not sufficient to control transmission, for instance,

if the organism has a low infective dose

if the organism may be transmitted from the source patient's intact skin

if there is potential for widespread environmental contamination.

Contact precautions should be used for

a. acute diarrhea of likely infectious cause if uncontrolled (incontinent, stool cannot be contained in diapers or incontinence briefs and resident is not confined to bed)[207,208];

b. extensive desquamating skin disorder with known or suspected infection or significant colonization;

c. skin rash compatible with scabies[213,214];

d. draining, infected wound in which drainage cannot be contained by dressing[212];

e. varicella or disseminated herpes zoster (with airborne precautions);

f. should be considered during outbreaks of influenza in the facility (with droplet precautions)[88].

The following precautions are in addition to routine practices:

a. Efforts should be made to maintain a 1 metre spatial separation between the infected resident and other residents and visitors. **BIII**

b. Participation in group activities should be restricted until the symptoms are resolved/treated. **BIII**

c. Room-mates and visitors must be aware of precautions to follow. **BIII**

d. Gloves and gowns should be used if direct contact with the resident is required *or* if direct contact with frequently touched environmental surfaces is anticipated and significant contamination of the environment is occurring (uncontrolled diarrhea, uncontained wound drainage, excessive skin desquamation). **BIII**

e. All designated equipment/supplies should be identified and stored in a manner that prevents use by or for other residents. **BIII**

f. Environmental soiling should be minimized through use of wound dressings, incontinence products, tissues. **BIII**

4. Care of Residents with Antimicrobial Resistant Organisms (ARO)

a. Policies

Access to appropriate care should not be denied because of colonization or infection with ARO[26,27,42,100,141,147,336]. **BIII**

When transferring an individual known to have an ARO between facilities, communication (preferably between infection control personnel) should occur prior to the transfer to ensure appropriate accommodation and plan of care[26,42,95, 47,193,196,336]. **BIII**

Policies for managing ARO, including initiation and discontinuation of precautions, should be in place that reflect the local experience with particular ARO and that are flexible enough to accommodate the various characteristics of different ARO[41,118,144,157,160,196,331,337]. It is important to collaborate with local or regional public health departments and infection control practitioners from other institutional settings in order to design a comprehensive control program. **BIII**

Management strategies take into consideration risks-benefits of both the resident and the institution based on individual resident assessment[338,339]. Controlling transmission is primarily the responsibility of direct care givers through hand washing and appropriate use of gloves[158]. Ability to maintain hygiene by both the resident and caregivers, individualized activity restrictions, selection of low-risk room-mate, and environmental cleanliness are also factors that require consideration[157,158]. **BIII**

b. Precautions

The following precautions are to be taken in addition to routine practices. These may need to be adjusted depending on the type of organism or symptoms, or in outbreak situations.

1. *Resident placement and activities*[42,147,157,164,336]

A single room with individual toileting facilities (e.g. designated bathroom or commode) is used if the resident has a condition likely to increase dissemination of organisms into the environment, i.e.

- diarrhea or fecal incontinence not contained by incontinence briefs or diapers
- wound or stoma not covered with a dressing or appliance to contain drainage
- desquamating skin condition and skin colonization
- colonized tracheostomy or pneumonia with uncontrolled respiratory secretions. **BIII**

Residents with the same organism may be grouped (charted). **BIII**

Residents without these risk factors may share accommodation. Shared accommodation must be with a low-risk room-mate, i.e.,
- no open wounds, decubitus ulcers
- no urinary catheters, feeding tubes or other invasive devices
- not debilitated or bed-bound requiring extensive hands-on care[42,100,141,147,148, 51,157,189]. **BIII**

Residents should not be excluded from social or other group activities unless they are likely to be shedding large numbers of organisms (see above) *and* they have been implicated in causing infection in other residents[26,42,158]. Cover wounds with fresh dressings and wash resident's hands just before group activities[158]. **BIII**

2. *Hand washing*

Hands should be washed after direct contact with the resident, after handling body secretions or contaminated equipment/environment and after removing gloves[26,100,260,327]. **BIII**

There are insufficient data specific to long term care to determine whether an antiseptic agent is necessary or whether plain soap will suffice. Consider using an antiseptic agent if transmission is occurring in the facility. **C**

Antiseptic hand rinses may be substituted for hand washing. **BIII**

When there is visible soiling, hands should be washed with soap and water before using waterless antiseptic hand rinses. **BIII**

3. *Protective apparel*[26,42]

Gloves, gowns and eye protection should be used as in routine practices. **BIII**

4. *Environmental cleaning*[100,188,340]

No special cleaning is required in the absence of evidence of an outbreak. (see Part B. Section I.A.6).

In outbreaks, consideration should be given to more frequent cleaning and/or cleaning with low level disinfectant. This includes bathing and toileting facilities, recreational equipment, horizontal surfaces in the resident room and, in particular, areas/items that are frequently touched, e.g. hand rails, light cords. Furniture made of materials that cannot be

cleaned/disinfected should not be used. Shared common areas for bathing and toileting should be cleaned after each use. Dining or lounge areas should be cleaned according to regular schedules and if visibly soiled. **BIII**

When precautions are discontinued or the resident is moved, thorough cleaning of the room and changing of privacy curtains and string/cloth call bells or light cords is required.

5. *HCW and resident education*[26,42,100,193]

   All employees should receive general information regarding ARO and their associated risks and specific information about prevention as it relates to the specific tasks they perform.

   Residents and family should receive appropriate information about ARO, associated risks and preventive measures. Resident information sheets may be an adjunct to providing consistent information. **BIII**

6. *Duration of precautions*

   There are no data at present on which to base recommendations for duration of precautions for persons colonized with ARO. Policies will need to be developed locally, taking into consideration the specific microorganism, the resident/patient population, and local experience with duration of colonization. These policies should be updated as data become available.

III. Recommendations for Ambulatory Care

A. Routine practices for ambulatory care

This section recommends practices for routine care in ambulatory care settings such as clinics, offices and emergency rooms and incorporates previous precautions against bloodborne pathogens (Universal Precautions).

Unique, specific ambulatory care settings, such as day treatment centres providing prolonged therapy to immunocompromised clients, may warrant more intensive precautions, similar to those used for hospitalized patients.

1. Hand Washing/Hand Antisepsis

a. Hands must be washed[231,249]
   between clients
   before any contact with immunocompromised clients
   before performing invasive procedures
   after contact with blood, body fluids, secretions and excretions, drainage from wounds
   after contact with items known or considered likely to be contaminated with blood, body fluids, secretions, or excretions (e.g. wound dressings)
   immediately after removing gloves[268]
   between certain procedures on the same client in which soiling of hands is likely, to avoid cross-contamination of body sites[258,277]
   when hands are visibly soiled. **AII**

b. Plain soap may be used for routine hand washing. **BII**

c. Hand antisepsis with an antiseptic soap or hand rinse is indicated[233,234]
   before performing invasive procedures
   before contact with immunocompromised clients, clients with extensive skin damage, or clients with percutaneously implanted devices. **BIII**

d. Waterless antiseptic hand rinses are an acceptable alternative to soap and water in reducing hand contamination[258-260,265] and should be made available as an alternative to hand washing. Antiseptic hand rinses are especially useful when the time for hand washing or access to hand washing facilities is limited. **AII**

When there is visible soiling, hands should be washed with soap and water before using waterless antiseptic hand rinses. If soap and water are unavailable, cleanse hands first with detergent-containing towelettes[233]. **BIII**

e. Adequate facilities for hand washing need to be ensured, e.g. wall-mounted soaps or antiseptics, paper towels, adequate numbers and appropriate placement of sinks. **BIII**

2. Gloves

a. Gloves are not required for routine care activities in which contact is limited to a client's intact skin. **BIII**

b. Gloves should be used as an additional measure, not as a substitute for hand washing[267,268]. **BII**

c. Gloves may not be needed for routine diaper changes if the procedure can be done without contaminating the hands with stool or urine. **C**

d. Clean, non-sterile gloves should be worn[21,108,272,304-306].

for contact with blood, body fluids, secretions and excretions, mucous membranes, draining wounds or non-intact skin (open skin lesions or exudative rash)

when handling items visibly soiled with blood, body fluids, secretions and excretions

when the health care worker has open skin lesions on the hands. **AII**

e. When indicated, gloves should be put on directly before contact with the client or before the procedure requiring gloves[178,276,277]. **AII**

f. Gloves should be changed between care activities and procedures with the same client after contact with materials that may contain high concentrations of microorganisms[268,277], e.g. handling an indwelling urinary catheter or suctioning a tracheostomy. **BIII**

g. Gloves should be removed immediately after completion of care or procedure, at point of use and before touching clean environmental surfaces[178,276,77]. **AIII**

h. Hands should be washed immediately after removing gloves[267,268]. **AII**

i. Single-use disposable gloves should not be reused or washed[267]. **AII**

For further information and recommendations on glove use, refer to *Infection Control Guidelines: Hand Washing, Cleaning, Disinfection and Sterilization in Health Care*[232] and

Infection Control Guidelines: Preventing the Transmission of Bloodborne Pathogens in Health Care and Public Services Settings[21].

3. Mask, Eye Protection, Face Shield

Masks and eye protection or face shields should be worn where appropriate to protect mucous membranes of the eyes, nose and mouth during procedures and care activities likely to generate splashes or sprays of blood, body fluids, secretions, or excretions[21,304,307]. **BIII**

4. Gowns

Gowns should be used to protect uncovered skin and prevent soiling of clothing during procedures and client care activities likely to generate splashes or sprays of blood, body fluids, secretions, or excretions[21,307]. **BIII**

5. Equipment and Environment

a. Articles that touch the client's intact skin should be clean. For items that are only in contact with intact skin, if cleaning between clients is not feasible, a routine cleaning schedule should be established and monitored. **BIII**

b. Equipment touching mucous membranes or non-intact skin, including tonometers and endoscopes, should be appropriately disinfected between clients[232]. **AIII**

c. A barrier (sheet or paper) should be placed on the examining or procedure table and changed between clients. Alternatively, the table should be cleaned between clients. **BIII**

d. The examining table should be cleaned between clients if visible soiling occurs, and at least daily. **BIII**

e. Chairs, cabinets, counters, and charts are usually not an infection risk and should be cleaned on a regular basis. **BIII**

f. Physical therapy mats, table tops, and equipment handles should be covered with easy to clean, impervious materials. These should be cleaned regularly and if soiled. **BIII**

g. Soiled client care equipment should be handled in a manner that prevents exposure of skin and mucous membranes and contamination of clothing and the environment. **BIII**

h. Used needles and other sharp instruments should be handled with care to avoid injuries during disposal or reprocessing. Used sharp items should be disposed of in

designated puncture-resistant containers located in the area where the items were used[8,21,312]. **AIII**

i. Mouthpieces, resuscitation bags, or other ventilation devices should be provided for use in areas where the need to resuscitate is likely to occur[8,21]. **BIII**

For detailed information and recommendations regarding hand washing, glove use, cleaning, disinfection and sterilization of client care equipment, housekeeping, laundry and waste management, refer to Health Canada *Infection Control Guidelines: Hand Washing, Cleaning, Disinfection, and Sterilization in Health Care*[232] and *Preventing the Transmission of Bloodborne Pathogens in Health Care and Public Services Settings*[21].

B. Additional precautions for ambulatory care

Additional precautions, as well as routine practices, are necessary for certain pathogens or clinical presentations. These precautions are based on method of transmission and are necessary for infections transmitted by the airborne or large droplet routes. They may be indicated for clients with certain highly transmissible or epidemiologically important microorganisms transmitted by direct or indirect contact.

Client and Family Teaching: This is an important aspect of health care that should not be overlooked. Clients and their families should understand the nature of their infectious disease and the precautions being taken, as well as the prevention of transmission of disease to family and friends.

Transport: Transportation services should have policies and procedures in place for transporting clients with transmissible infections. If any additional precautions are indicated during transport, the facility should inform the personnel transporting the client which precautions are required.

1. Airborne Transmission Precautions

(airborne precautions should be taken for the organisms listed in Table 3)

Precautions to be taken in addition to routine practices are as follows.

a. Clients with known or suspected infectious tuberculosis, measles, varicella or disseminated zoster should not wait in a common waiting room but be placed directly into an examining room. Preferably, this should be a negative pressure room with exhaust vented to the outside or filtered through a high efficiency filter if recirculated[78,80,81]. **BIII**

b. If such a room is not available in the facility, a single room should be used and the client examined and discharged as quickly as possible.

The door must remain closed.

If feasible, the visit should be scheduled at times to minimize exposure of other clients, such as at the end of the day.

Personnel should be immune to measles.

Varicella-susceptible personnel should not enter the room of a client with varicella or disseminated zoster.

For protective apparel and client transport, see Airborne Transmission Precautions in Acute Care Settings (Part B. Section I.B.1).

The client should wear a surgical/procedure mask when not in a negative pressure room.

In the case of varicella, items and surfaces that may have been in contact with skin lesions should be cleaned before the next client is admitted to the room. **BIII**

If possible, allow sufficient time for the air to be free of aerosolized droplet nuclei before using the room for another client (tuberculosis) or for a non-immune client (measles or varicella). The duration will depend on the rate of air exchange in the room. Refer to Health Canada *Guidelines for Preventing the Transmission of Tuberculosis in Canadian Health Care Facilities and Other Institutional Settings*[20], page 46, for further details. Measles transmission has been reported up to 90 minutes after the index case has left the room[80]. **BIII**

2. Droplet Transmission Precautions

Precautions to be taken in addition to routine practices are as follows.

a. If feasible, place client directly into a single room, especially if he or she has known or suspected meningococcal infection, rubella, mumps, pertussis, diphtheria or hemorrhagic fevers. If this is not possible, place client in area of waiting room separated from other clients by at least 1 metre, and minimize time spent in waiting room. **BIII**

b. For protective apparel and client transport, see Droplet Transmission Precautions in Acute Care Settings (Part B. Section I.B.2). **BIII**

c. If possible, consider separate waiting rooms or areas for well child visits and for children with acute respiratory infections, especially during community outbreaks. **BIII**

3. Contact Transmission Precautions and Precautions for ARO

Contact transmission precautions should be taken for:

diarrhea

extensive skin or wound infection not contained by dressings

hemorrhagic fevers

meningitis

hepatitis

herpes simplex, disseminated

scabies (extensive or Norwegian/crusted)

varicella

disseminated or extensive uncovered zoster

ARO (See Part B. Section I.B.4)

In addition to routine practices the following precautions should be taken:

a. For protective apparel and client transport see Contact Transmission Precautions in Acute Care Settings (Part B. Section I.B.3).

b. Wash hands with antiseptic or use antiseptic hand rinse after direct contact with client or contaminated items. **BIII**

   When there is visible soiling, hands should be washed with soap and water before using waterless antiseptic hand rinses. If soap and water are not available, clean hands with detergent-containing towelette[233]. **BIII**

   For ARO, there are insufficient data specific to ambulatory care to determine whether an antiseptic agent is neccessary or whether plain soap will suffice. **C**

c. Equipment and surfaces in direct contact with the client or infective material (e.g. respiratory secretions, stool or skin exudates) should be cleaned before the room is used for another client[216].

   If client is likely to cause extensive environmental contamination (diarrhea or fecal incontinence not contained by diapers, copious wound drainage, copious uncontrolled respiratory secretions or sputum) all horizontal surfaces and frequently touched surfaces should be cleaned before the room is used for another client. **BIII**

d. There are no data at present on which to base recommendations for duration of precautions for persons colonized with ARO. Policies will need to be developed locally, taking into consideration the specific microorganism, the client population, and local experience with duration of colonization. These policies should be updated as data become available.

IV. Recommendations for Home Care

This section recommends practices for the routine care of all patients and health care clients and incorporates previous precautions against bloodborne pathogens (Universal Precautions).

A. Routine practices for home care

1. Hand Washing/Hand Antisepsis

a. Hands must be washed[223,224,231,341]

before and after direct contact with the client. Direct contact refers to hand contact with the client's skin.

Special consideretions: The need for hand washing after casual contact unrelated to health care should be judged on an individual basis[a]

before any contact with immunocompromised clients

before performing invasive procedures

after contact with blood, body fluids, secretions and excretions, and exudates from wounds

after contact with items known or considered likely to be contaminated with blood, body fluids, secretions, or excretions (e.g. bedpans, urinals, and wound dressings)

immediately after removing gloves[298]

between certain procedures on the same client where soiling of hands is likely, to avoid cross-contamination of body sites[258,277]

before preparing, handling, serving or eating food and before feeding a client

when hands are visibly soiled

after personal use of toilet or wiping nose. **AII**

b. Plain soap may be used for routine hand washing[223,224]. **BII**

---

a The line between casual contact, such as a handshake or holding the hand of the client, and health care is difficult to define. For casual or social contact that involves direct contact between the skin of the HCW and the client, consider the likelihood of the client's skin being contaminated or colonized with significant organisms, the extent of the contact (e.g. handshake, hug, vs holding client for prolonged period), and whether or not the client is immunocompromised.

c. The HCW should carry a waterless antiseptic hand rinse to use if adequate hand washing facilities are not available. **BIII**

d. Hand antisepsis with an antiseptic soap or hand rinse is indicated[233,234]

before performing invasive procedures, e.g. intravenous insertion, airway suctioning, urinary catheter insertion, wound care, enteral feedings, hemodialysis or peritoneal dialysis

for care of the immunocompromised client, client with extensive skin damage or with a percutaneously implanted device. **BIII**

When there is visible soiling, hands should be washed with soap and water before using waterless antiseptic hand rinses. If soap and water are not available, cleanse hands with detergent-containing towelettes[233]. **BIII**

e. Hands should be washed before handling equipment inside the nursing bag[224]. **BIII**

f. HCW should not use the client's towels for drying hands. Carry paper or other disposable towels. **BIII**

2. Gloves

a. Gloves are not required for routine care activities in which contact is limited to intact skin. **BIII**

b. Gloves should be used as an additional measure, not as a substitute for hand washing[267,268]. **BII**

c. Gloves may not be needed for routine diaper changes or changes of incontinence briefs if the procedure can be done without contaminating the hands with stool or urine. **C**

d. Clean, non sterile gloves should be worn[21,224,272,304-306]

for contact with blood, body fluids, secretions and excretions, mucous membranes, draining wounds or non-intact skin (open skin lesions or exudative rash)

when handling items visibly soiled with blood, body fluids, secretions and excretions

when the health care worker has open skin lesions on the hands. **AII**

e. When indicated, gloves should be put on directly before contact with the client or potentially contaminated material or before the procedure for which gloves are required[179,276,277]. **AII**

f. Gloves should be changed between care activities and procedures with the same client after contact with materials that may contain high concentrations of microorganisms[268,277], e.g. handling an indwelling urinary catheter or suctioning a tracheostomy. **BIII**

g. Gloves should be removed immediately after completion of the procedure or after care, at point of use and before touching clean environmental surfaces[178,276,277]. **AIII**

h. Hands should be washed immediately after removing gloves[267,268]. **AII**

i. Single-use disposable gloves should not be reused or washed[267]. **AII**

3. Mask, Eye Protection, Face Shield

Masks and eye protection or face shields should be worn where appropriate to protect mucous membranes of the eyes, nose and mouth during procedures and client care activities likely to generate splashes or sprays of blood, body fluids, secretions, or excretions[21,224,226,304,307]. **BIII**

4. Gowns/Aprons

a. There are no data to support or refute the routine use of gowns or aprons for infection control purposes in health care delivery in the home. **C**

b. Gowns should be used to protect uncovered skin and prevent soiling of clothing during procedures and client care activities likely to generate splashes or sprays of blood, body fluids, secretions, or excretions, or where soiling of clothing is anticipated[21,307]. **BIII**

5. Equipment and Environment[223,224]

a. The nursing bag should be considered as a piece of clean equipment and handled in such a way as to prevent contamination from hands or used equipment. **BIII**

b. Used equipment should be placed in an impervious container after use and not returned to the nursing bag. **BIII**

c. Used equipment should be cleaned and, where appropriate, disinfected before use with another client or before returning it to the nursing bag. **BIII**

d. Procedures for cleaning and reprocessing of used health care equipment should be established and monitored. **BIII**

e. Environmental soiling should be minimized, e.g. with the appropriate handling and disposal of wound dressings, incontinence products, tissues. **BIII**

For further information and recommendations on hand washing, glove use, cleaning and disinfection of health care equipment, housekeeping, linen and waste management, refer to Health Canada *Infection Control Guidelines: Hand Washing, Cleaning, Disinfection, and Sterilization in Health Care*[232] and *Preventing the Transmission of Bloodborne Pathogens in Health Care and Public Services Settings*[21].

B. Additional precautions for home care

Additional precautions, as well as routine practices, are necessary for certain pathogens or clinical presentations. These precautions are based on method of transmission and are necessary for infections transmitted by the airborne or large droplet routes. They may be indicated for clients with certain highly transmissible or epidemiologically important microorganisms transmitted by direct or indirect contact.

Client and Family Teaching: This is an important aspect of health care that should not be overlooked. Clients and their families should understand the nature of their infectious disease and the precautions being used, as well as the prevention of transmission of disease to family and friends.

1. Airborne Transmission Precautions[224,226]

(airborne precautions should be used for the organisms listed in Table 3)

Precautions to be taken in addition to routine practice are as follows:

If the client has infectious tuberculosis, the HCW should wear an appropriate mask[a] at all times while in the home until the client is deemed noninfectious.

The HCW should be immune to varicella if caring for a client who has varicella or herpes zoster or for a susceptible exposed client who is in the incubation period.

All HCWs should be immune to measles. A HCW who is not immune should not provide care for a client with measles or for a susceptible exposed client who is in the incubation period.

---

a Masks should filter particles one micron in size, have a 95% filter efficiency and provide a tight facial seal (less than 10% leak). Provided that an adequate facial seal is present, respirators that are NIOSH certified as N95, N99, N100, R95, R99, R100, P95, P99 or P100 meet or exceed the minimum recommendation. Other masks may meet these requirements. Check manufacturers' written specifications. See Health Canada *Guideline for preventing the transmission of tuberculosis in Canadian health care facilities and other institutional settings*[225] for further details.

Airborne precautions should be discontinued only after the client is no longer infectious. **BIII**

2. Droplet Transmission Precautions

Routine care practices should be sufficient to reduce the risk of transmission of most infections spread by droplets.

Non immune HCWs should wear surgical/procedure masks for close contact (< 1 metre) of clients with mumps or rubella.

Masks should be worn for close contact (<1 metre) with clients with suspected or diagnosed pertussis or aplastic crisis associated with parvovirus B19 infection. **BIII**

3. Contact Transmission Precautions

Additional precautions may be indicated for certain organisms if routine precautions are not sufficient to control transmission, for instance,

if the organism has a low infective dose

if the organism may be transmitted from the source patient's intact skin

if there is potential for widespread environmental contamination.

Use contact precautions in the following circumstances:

acute diarrhea of likely infectious cause if uncontrolled (i.e. stool cannot be contained in diapers or incontinence briefs)

extensive desquamating skin disorder with known or suspected infection or significant colonization

skin rash compatible with scabies[213,214]

draining, infected wound when drainage cannot be contained by dressing[212]

varicella or disseminated zoster (with airborne precautions).

Contact precautions, in addition to routine practices, include the following:

a. Gloves and gowns should be used if substantial direct contact with the client is required or if direct contact with frequently touched environmental surfaces is anticipated and significant contamination of the environment is occurring (uncontrolled diarrhea, uncontained wound drainage, excessive skin desquamation). **BIII**

b. Hands should be washed after care of client. **BIII**

c. There are insufficient data to determine whether an antiseptic is required or whether plain soap and water will suffice. **C**

4. Care of Clients with Antibiotic Resistant Organisms (ARO)[218, 224-226,228,336,342,343]

Access to appropriate care should not be denied because of colonization or infection with ARO. **BIII**

Routine screening of potential clients for ARO or requiring proof of screening before providing service is not recommended. **AIII**

Referral of a client known to have an ARO to a health care facility/service should be preceded by direct communication (preferably with infection control personnel) regarding ARO status, to ensure appropriate precautions. **BIII**

It is important to collaborate with local or regional public health departments and infection control practitioners in order to design a comprehensive control program. In some jurisdictions such collaboration may be appropriate with the local broker of home care services.

The following precautions are to be taken in addition to routine practices. These may need to be adjusted depending on the type of organism or symptoms, or in outbreak situations[336,342,343].

1. *Client activities*

   Individual client care planning should strive toward maximal participation in social and rehabilitative activities and freedom of movement in the community while minimizing risk of transmission. **BIII**

2. *Hand washing*

   Hands should be washed after direct contact with the client, after handling body secretions or contaminated equipment/environment, after removing gloves, and before leaving the client's home. **BIII**

   There are insufficient data specific to home care to determine whether an antiseptic agent is necessary or whether plain soap and water will suffice. **C**

   When there is visible soiling, hands should be washed with soap and water before using waterless antiseptic hand rinses. If soap and water are unavailable, cleanse hands with detergent-containing towelettes[233]. **BIII**

3. *Equipment and environment*

   Equipment should be cleaned and disinfected before transport to and use with another client. **BIII**

4. *HCW and client education*

   All employees should receive general information regarding ARO and their associated risks and specific information about prevention as it relates to their jobs.

Clients and family should receive appropriate information about ARO, associated risks and preventive measures. Client information sheets may be an adjunct to providing consistent information. **BIII**

5. *Duration of precautions*

There are no data at present on which to base recommendations for duration of precautions for persons colonized with ARO. Policies will need to be developed locally, taking into consideration the specific microorganism, the client population, and local experience with duration of colonization. These policies should be updated as data become available. **BIII**

V. Responsibility for Initiation of Additional Precautions

Routine infection control practices should be incorporated into everyday patient/resident/client care. Institutional policy should provide for education of every care provider in the principles of routine precautions, provision of adequate equipment to implement them, and a means by which compliance with practice can be monitored and audited.

To minimize the risk of transmission of infection, patients/residents/clients (referred to henceforth as "patients") should be thoroughly assessed for infection or potential infections upon admission and regularly throughout their stay. Each facility should endeavour to have some assessment procedure in place; the results should be communicated to other personnel providing care and should be documented in the patient record.

In situations requiring additional precautions, these precautions must be instituted as soon as indicated by triggering mechanisms such as diagnosis, symptoms of infection, laboratory information, or assessment of risk factors.

It is not necessary to wait for a specific diagnosis or microbiologic confirmation before initiating appropriate precautions when patient assessment clearly indicates a clinical syndrome or risk factors related to a potentially transmissible disease. For the patient who has or is suspected of having a disease requiring additional precautions above and beyond routine practices, it is important to institute these precautions immediately. They may be instituted by any health care provider as soon as disease or risk factors are suspected or identified. This may be done in keeping with established institutional policy or in collaboration with infection control personnel.

The institution/facility is responsible for ensuring that appropriate precautions are taken for specific patients. Each institution should designate clearly, as a matter of policy, the personnel responsible on a day-to day basis for instituting appropriate transmission precautions, the notification processes required once precautions have been initiated, the person responsible for modifying or discontinuing precautions, and the person who has ultimate authority to make decisions regarding precautions and bed allocation when conflict arises.

In outbreaks, precautions may have a more global impact. Often the ultimate decision making may shift to those responsible during crisis situations. However, these decisions should always be made in collaboration with infection control and public health personnel to ensure that the optimal practices are employed to control transmission.

All personnel (physicians, nurses, technicians, students, volunteers and others) are responsible for complying with routine and additional precautions and for tactfully calling observed

infractions to the attention of all offenders. There are no hierarchical exceptions to precautions, and everyone has a responsibility to monitor his or her own practice as well as the practice of other care providers. There are no exceptions, and all should teach by example.

Patients and visitors also have a responsibility to comply with precautions where indicated. Teaching of basic principles such as hand washing, gloving etc. is the responsibility of all health care providers.

It is also important that patients not be subjected to unnecessary precautions and that precautions be discontinued when no longer indicated.

VI. Tools for Implementation of Precautions

A. Establishing priorities for single rooms

Where single rooms are limited in number, the institution should set priorities for their use, based on risk factors for transmission or adverse outcome inherent to the patient, microbe and institution.

Refer to Part A. Section IV and Tables 1 and 2 to determine risk of transmission and disease in the setting. Consider the severity of the outcome should transmission occur, for example, in the following (descending order of priority):

airborne infections

droplet transmission if patients cannot be kept > 1 metre apart

influenza if in a high-risk unit

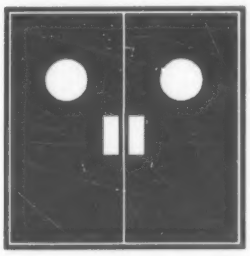
patients with infections spread by contact and who are non-compliant and cannot be confined to bed:

- diarrhea in incontinent patient, not contained by diapers
- respiratory tract infection in child, unable to appropriately handle respiratory secretions
- infected wound or skin drainage not contained by dressings.

B. Examples of cards for additional precautions

AIRBORNE PRECAUTIONS

Visitors: Please report to nursing station before entering room.

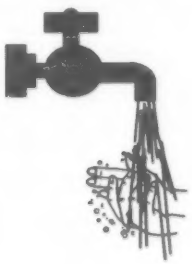


PATIENT PLACEMENT

Single room
Keep door closed

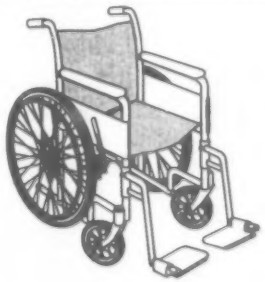
MASK

Special high-efficiency mask upon entering the room



HAND WASHING

Before direct contact with patient
After touching contaminated articles
After direct contact with patient

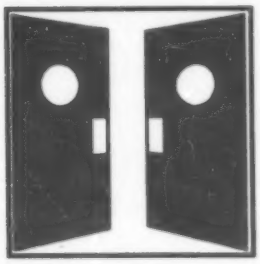


PATIENT TRANSPORT

Transport for essential purposes only
Patient must wear surgical/procedure mask during transport
Notify receiving department

DROPLET PRECAUTIONS

Visitors: Please report to nursing station before entering room.

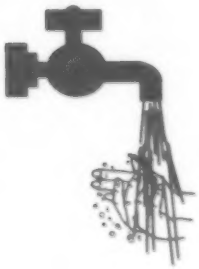


PATIENT PLACEMENT

Maintain a distance of at least 1 metre (3 feet) between patients
Door may remain open

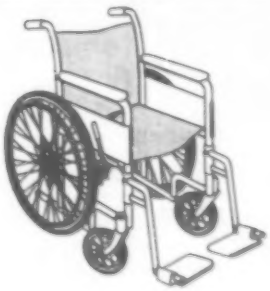
MASK

Surgical/procedure mask within 1 metre (3 feet) of patient



HAND WASHING

Before direct contact with patient
After touching contaminated articles
After direct contact with patient

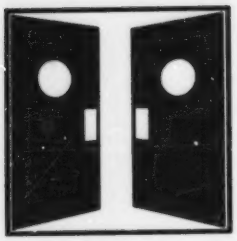


PATIENT TRANSPORT

Transport for essential purposes only
Patient must wear surgical/procedure mask during transport
Notify receiving department

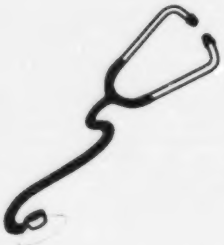
CONTACT PRECAUTIONS

Visitors: Please report to nursing station before entering room.



PATIENT PLACEMENT

Maintain a distance of at least 1 metre (3 feet) between patients
Door may remain open

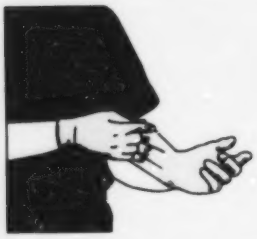


PATIENT CARE EQUIPMENT

Dedicate to this patient or disinfect after use

GOWN

If contamination or soiling is likely



GLOVES

On entry into patient's room or bedspace

HAND WASHING

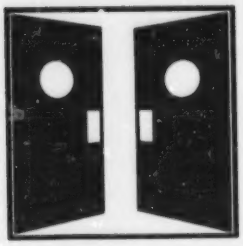
After removing gloves
After touching contaminated articles

PATIENT TRANSPORT

Transport for essential purposes only
Notify receiving department

DROPLET / CONTACT PRECAUTIONS

Visitors: Please report to nursing station before entering room.



PATIENT PLACEMENT

Maintain a distance of at least 1 metre (3 feet) between patients
Door may remain open

PATIENT CARE EQUIPMENT

Dedicate to this patient or disinfect after use

MASK

Surgical/procedure mask within 1 metre (3 feet) of coughing patient

GOWN

If contamination is likely

GLOVES

On entry into patient's room or bedspace

HAND WASHING

After removing gloves
After touching contaminated articles

PATIENT TRANSPORT

Transport for essential purposes only
Patient must wear surgical/procedure mask during transport
Notify receiving department

C. Transmission summary tables

These tables summarize imformation about transmission characteristics of most infectious diseases and should be used in conjunction with the text.

Table 6 lists *empiric* precautions to be taken for specific clinical presentations when the microorganism involved is not known. These should be used initially, while awaiting more precise diagnosis.

Table 7 lists precautions to be taken for infections due to specific microorganisms once the etiology of the infection has been determined.

Tables 6 and 7 are intended for acute care settings. Persons wishing to use them in other settings should consider appropriate modifications (refer to text).

TABLE 6. Transmission Characteristics and Empiric Precautions by Clinical Presentation: Recommendations for Acute Care Centres

Clinical findings	Potential pathogens	Empiric precautions	Infective material	Route of transmission	Duration of precautions	Comments
Abscess	*Staphylococcus aureus*, *Streptococcus gr. A*, many other bacteria	Major: Contact Minor: Routine	Pus	Direct and indirect contact	Duration of drainage	Major = drainage not contained by dressing.
Bronchiolitis	Respiratory syncytial virus (RSV), parainfluenza virus, influenza, adenovirus	ADULT: Routine PEDIATRIC: Droplet and Contact	Respiratory secretions	Large droplet and direct and indirect contact	Duration of illness	May cohort if infected with same virus. Minimize exposure of immunocompromised patients, children with chronic cardiac or lung disease, neonates.
Burns, infected See abscess						
Cellulitis Draining: See abscess Periorbital or other with intact skin	*Haemophilus influenzae* type b in non-immune child < 5 years of age; *Streptococcus pneumoniae*, *Streptococcus gr. A*, *Staphylococcus aureus*, other bacteria	Droplet if *Haemophilus influenzae* type b is possible cause, otherwise routine	Respiratory secretions	Large droplet, direct contact	Until 24 hours of appropriate antimicrobial therapy received unless *Haemophilus influenzae* type b ruled out	
Common cold	Rhinovirus, RSV, parainfluenza, influenza, adenovirus, coronavirus	ADULT: Routine PEDIATRIC: Droplet and Contact	Respiratory secretions	Large droplet and direct and indirect contact	Duration of illness	May cohort if infected with same virus. Minimize exposure of immunocompromised patients, children with chronic cardiac or lung disease, neonates.
Conjunctivitis	Adenovirus, enterovirus, chlamydia, gonococcus, other bacteria	ADULT: Routine PEDIATRIC: Contact	Eye discharge	Direct and indirect contact	Until viral etiology ruled out; duration of symptoms if viral	Routine if non-viral.
Cough, fever, acute upper respiratory tract infection	Rhinovirus, RSV, parainfluenza, influenza, adenovirus, coronavirus, pertussis, mycoplasma	ADULT: Routine PEDIATRIC: Droplet and Contact	Respiratory secretions	Large droplet, direct and indirect contact	Duration of illness or until infectious etiology ruled out	May cohort if infected with same virus. Minimize exposure of immunocompromised patients, children with chronic cardiac or lung disease, neonates. Consider fever and asthma in child < 2 years old as viral infection.

Note: Use pediatric precautions for children who are incontinent or too immature to be able to comply with handwashing requirements, appropriate handling and disposal of respiratory secretions, purulent discharges and skin exudates, and maintenance of dressings in place. For older children who are continent and able to comply with precautions for respiratory secretions and skin lesions, precautions for adults may be used.

TABLE 6. Transmission Characteristics and Empiric Precautions by Clinical Presentation: Recommendations for Acute Care Centres

Clinical findings	Potential pathogens	Empiric precautions	Infective material	Route of transmission	Duration of precautions	Comments
Cough, fever, pulmonary infiltrates in person at risk for tuberculosis	*Mycobacterium tuberculosis*	Airborne	Respiratory secretions	Airborne	Until tuberculosis ruled out or Until patient has received at least two weeks of effective treatment and is clinically improved, and three sputa taken 24 hours apart are negative for AFB. Until negative sputum culture if multi-drug resistant tuberculosis	See *Guidelines for Preventing the Transmission of Tuberculosis in Canadian Health Care Facilities and Other Institutional Settings*[70]
Croup	Parainfluenza, influenza, RSV, adenovirus	ADULT: Routine PEDIATRIC: Droplet and Contact	Respiratory secretions	Large droplet, direct and indirect contact	Duration of illness or until infectious cause ruled out	May cohort if infected with same virus. Minimize exposure of immunocompromised patients, children with chronic cardiac or lung disease, neonates.
Decubitus ulcer, infected See abscess						
Dermatitis See abscess	Many (bacteria, virus, fungus)	Contact	Skin exudates	Direct and indirect contact	Until infectious etiology ruled out	If compatible with scabies take appropriate precautions pending diagnosis.
Desquamation, extensive See abscess	*Staphylococcus aureus*	Contact	Skin exudates	Direct and indirect contact	Until skin exudates contained or infection ruled out	
Diarrhea Acute diarrhea of likely infectious cause	Several bacteria, viruses, parasites	ADULT: Routine* PEDIATRIC: Contact	Feces	Direct and indirect contact (fecal/oral)	Until normal stools or infectious etiology ruled out	*Consider Contact precautions for incontinent adults if feces cannot be contained or for adults with poor hygiene who contaminate their environment.
Suspected *Clostridium difficile* diarrhea	*Clostridium difficile*	Contact for adults and children				
Encephalitis	HSV, enterovirus, arbovirus	ADULT: Routine* PEDIATRIC: Contact*	Feces, respiratory secretions	Direct and indirect contact (fecal/oral)	Until specific etiology established or until enterovirus ruled out	*May be associated with measles, mumps, varicella, *Mycoplasma pneumoniae*, Epstein-Barr virus (EBV). If so, take appropriate precautions for associated disease.

Note: Use pediatric precautions for children who are incontinent or too immature to be able to comply with handwashing requirements, appropriate handling and disposal of respiratory secretions, purulent discharges and skin exudates, and maintenance of dressings in place. For older children who are continent and able to comply with precautions for respiratory secretions and skin lesions, precautions for adults may be used.

TABLE 6. Transmission Characteristics and Empiric Precautions by Clinical Presentation: Recommendations for Acute Care Centres

Clinical findings	Potential pathogens	Empiric precautions	Infective material	Route of transmission	Duration of precautions	Comments
Endometritis	*Streptococcus* group A; many other bacteria	Routine				
Epiglottitis	*Haemophilus influenzae* type b; *Streptococcus* gr A, *Staphylococcus aureus*	ADULT: Routine PEDIATRIC: Droplet if *Haemophilus influenzae* type b is possible cause, otherwise Routine	Respiratory secretions	Large droplet, direct contact	Until 24 hours of appropriate antimicrobial therapy received unless *Haemophilus influenzae* type b ruled out	
Erysipelas	*Streptococcus* gr A	Routine				
Fever of unknown origin, fever without focus (acute)	Enterovirus (June-December)	ADULT: Routine* PEDIATRIC: Contact	Feces, respiratory secretions	Direct or indirect contact (fecal/oral)	Duration of illness or until enteroviral infection ruled out	*If findings suggest a specific transmissible infection, take precautions for that infection pending diagnosis.
Food poisoning	*Bacillus cereus, Clostridium perfringens, Staphylococcus aureus, Salmonella, Vibrio parahaemolyticus, Escherichia coli* O157 and others	ADULT: Routine* PEDIATRIC: Contact if *Salmonella* or *Escherichia coli* O157 suspected, otherwise Routine	Feces if *Salmonella* or *Escherichia coli* O157	Foodborne; or direct and indirect contact (fecal/oral) if *Salmonella* or *Escherichia coli* O157	Until *Salmonella* or *Escherichia coli* O157 ruled out	*Consider Contact precautions for incontinent adults if stool cannot be contained or for adults with poor hygiene who contaminate their environment if *Salmonella* or *Escherichia coli* O157 suspected.
Furuncles See abscess	*Staphylococcus aureus*					
Gas gangrene	*Clostridiium* spp.	Routine				
Gastroenteritis See diarrhea						
Gingivostomatitis	HSV	Routine				Consider Contact precautions if extensive disease.
Guillain-Barré syndrome	Associated with many infections*					*Take precautions as appropriate for known or suspected associated infection.
Hand, foot and mouth disease	Enterovirus	ADULT: Routine PEDIATRIC: Contact	Feces, respiratory secretions	Direct and indirect contact (fecal/oral)	Duration of illness	
Hemolytic-uremic syndrome	May be associated with *E. coli* O157	ADULT: Routine* PEDIATRIC: Contact	Feces	Direct and indirect contact (fecal/oral)	Until *E. coli* O157 ruled out.	* Consider Contact precautions for incontinent adults if stool cannot be contained or for adults with poor hygiene who contaminate their environment.

Note: Use pediatric precautions for children who are incontinent or too immature to be able to comply with handwashing requirements, appropriate handling and disposal of respiratory secretions, purulent discharges and skin exudates, and maintenance of dressings in place. For older children who are continent and able to comply with precautions for respiratory secretions and skin lesions, precautions for adults may be used.

TABLE 6. Transmission Characteristics and Empiric Precautions by Clinical Presentation: Recommendations for Acute Care Centres

Clinical findings	Potential pathogens	Empiric precautions	Infective material	Route of transmission	Duration of precautions	Comments
Hemorrhagic fever acquired in appropriate endemic area	Ebola, Lassa, Marburg, and others*	Contact plus Droplet (Contact plus Airborne if pneumonia)	Blood and bloody body fluids; respiratory secretions	Direct and indirect contact; possibly airborne if pneumonia	Duration of illness or until hemorragic fever virus ruled out	Local public health authorities or regional officer of health and LCDC should be notified immediately. *Refer to *Canadian Contingency Plan for Viral Hemorrhagic Fevers and Other Related Diseases*[22]
Hepatitis of unknown etiology	HAV, HBV, HCV HEV, EBV and others	ADULT: Routine* PEDIATRIC: Contact	Feces; blood and certain body fluids	Direct and indirect contact (fecal/oral) for hepatitis A, E	For 7 days after onset of jaundice or until hepatitis A ruled out	*Consider Contact precautions for incontinent adults if stool cannot be contained or for adults with poor hygiene who contaminate their environment unless hepatitis A ruled out.
Herpangina	Enterovirus	ADULT: Routine PEDIATRIC: Contact	Feces, respiratory secretions	Direct and indirect contact (fecal/oral)	Duration of illness	
Impetigo See abscess	*Streptococcus* gr A, *Staphylococcus aureus*	Contact if extensive* otherwise Routine	Skin exudates	Direct and indirect contact	Until 24 hours of effective antimicrobial therapy	*Not covered by dressings
Kawasaki disease (Mucocutaneous lymph node syndrome)	Unknown	Routine				Not known to be transmissible
Meningitis	Bacterial: *Neisseria meningitidis, Haemophilus influenzae* type b, *Streptococcus pneumoniae, Streptococcus* group B, *Listeria monocytogenes, E. coli* and other Gram negative rods	ADULT: Droplet if possibly *Neisseria meningitidis* otherwise Routine PEDIATRIC: Droplet*	Respiratory secretions	Large droplet	Until 24 hours of appropriate antibiotic therapy received	*Pediatrics: precautions for both bacterial and viral until etiology established
	Tuberculosis	Routine*				*Rule out associated pulmonary tuberculosis.
	Viral: enterovirus	ADULT: Routine* PEDIATRIC: Contact*	Feces, respiratory secretions	Direct or indirect contact	Until enterovirus ruled out	*May be associated with measles, mumps, varicella, HSV. If so, take appropriate precautions for associated disease.
	Fungus	Routine				
Necrotizing enterocolitis	Unknown, probably many organisms	Contact*		Probably indirect contact	Duration of illness	*Unknown if transmissible. Take precautions if outbreak suspected.

Note: Use pediatric precautions for children who are incontinent or too immature to be able to comply with handwashing requirements, appropriate handling and disposal of respiratory secretions, purulent discharges and skin exudates, and maintenance of dressings in place. For older children who are continent and able to comply with precautions for respiratory secretions and skin lesions, precautions for adults may be used.

TABLE 6. Transmission Characteristics and Empiric Precautions by Clinical Presentation: Recommendations for Acute Care Centres

Clinical findings	Potential pathogens	Empiric precautions	Infective material	Route of transmission	Duration of precautions	Comments
Osteomyelitis	*Haemophilus influenzae* type b possible in non-immune infant < 2 years of age, *Staphylococcus aureus*, other bacteria	ADULT: Routine PEDIATRIC: Droplet if *Haemophilus influenzae* type b possible; otherwise Routine			Until 24 hours of effective antimicrobial therapy unless *Haemophilus influenzae* type b ruled out	
Otitis, draining See abscess						
Pharyngitis	*Streptococcus* gr A, viral, *Corynebacterium diphtheriae*	ADULT: Routine* PEDIATRIC: Droplet and Contact	Respiratory secretions	Direct and indirect contact; large droplets	Duration of illness; if *Streptococcus* gr A until 24 hours of antibiotic therapy received	*If diphtheria suspected see Table 7.
Pleurodynia	Enterovirus	ADULT: Routine PEDIATRIC: Contact	Feces, respiratory secretions	Direct and indirect contact (fecal/oral)	Duration of illness	
Pneumonia	Viruses, pertussis, *Mycoplasma*, *Streptococcus pneumoniae*, *Haemophilus influenzae* type b, *Staphylococcus aureus*, *Streptococcus* gr A, Gram negative enteric rods, *Chlamydia*, *Legionella*, *Pneumocystis*, fungi	ADULT: Routine PEDIATRIC: Droplet and Contact	Respiratory secretions	Large droplets, direct and indirect contact	Until etiology established, then as for specific organism; no special precautions for Gram negative pneumonia unless ARO	May cohort if infected with same virus. Minimize exposure of immunocompromised patients, children with chronic cardiac or lung disease, neonates.
Pseudomembranous colitis	*Clostridium difficile*	Contact	Feces	Direct and indirect contact (fecal/oral)	Until normal stools	
Rash compatible with scabies	Ectoparasite	Contact if extensive, otherwise Routine plus gloves and gown for direct patient contact	Mite	Direct and indirect contact	If confirmed, until 24 hours of appropriate therapy	See scabies, Table 7.
Rash (maculopapular) with fever and coryza	Measles	Airborne	Respiratory secretions	Airborne	If confirmed, until 4 days after onset of rash	See Measles, Table 7.

Note: Use pediatric precautions for children who are incontinent or too immature to be able to comply with handwashing requirements, appropriate handling and disposal of respiratory secretions, purulent discharges and skin exudates, and maintenance of dressings in place. For older children who are continent and able to comply with precautions for respiratory secretions and skin lesions, precautions for adults may be used.

TABLE 6. Transmission Characteristics and Empiric Precautions by Clinical Presentation: Recommendations for Acute Care Centres

Clinical findings	Potential pathogens	Empiric precautions	Infective material	Route of transmission	Duration of precautions	Comments
Rash (petechial/ purpuric) with fever	*Neisseria meningitidis*	ADULT: Droplet if *Neisseria meningitidis* suspected otherwise Routine PEDIATRIC: Droplet	Respiratory secretions	Large droplets, direct contact	If *N. meningitidis* confirmed, until 24 hours of appropriate antibiotic therapy received	
Rash (vesicular) with fever	Varicella	Airborne and Contact	Respiratory secretions, skin exudates	Airborne, direct and indirect contact	If confirmed, until all lesions are dry	See Chickenpox, Table 7.
Reye's syndrome	May be associated with viral infection, especially influenza, varicella					Precautions as for known or suspected associated viral infection
Scalded skin syndrome See *Staphylococcus aureus*, Table 7						
Septic arthritis	*Haemophilus influenzae* type b possible in non-immune infant < 5 years of age; *Staphylococcus aureus*, *Streptococcus pneumoniae*, *Streptococcus* gr A, other bacteria	ADULT: Routine PEDIATRIC: Droplet if *Haemophilus influenzae* type b possible; otherwise Routine			Until 24 hours of appropriate antimicrobial therapy received unless *Haemophilus influenzae* type b ruled out	
Skin infection See abscess						
Toxic shock syndrome	*Staphylococcus aureus*, *Streptococcus* gr A	Routine*				*See abscess if drainage or skin exudates.
Urinary tract infection	Many	Routine unless ARO				
Vincent's angina, Trench mouth	Multiple bacteria	Routine				Usually normal flora.
Wound infection (see abscess)						

Note: Use pediatric precautions for children who are incontinent or too immature to be able to comply with handwashing requirements, appropriate handling and disposal of respiratory secretions, purulent discharges and skin exudates, and maintenance of dressings in place. For older children who are continent and able to comply with precautions for respiratory secretions and skin lesions, precautions for adults may be used.

TABLE 7. Transmission Characteristics and Precautions by Specific Etiology: Recommendations for Acute Care Centres

Microorganism	Clinical presentation	Precautions	Infective material	Route of transmission	Incubation period	Period of communicability	Duration of precautions	Comments
Actinomycosis (*Actinomyces* sp.)	Cervicofacial, thoracic or abdominal infection	Routine			Variable	Not person-to-person		Normal flora; infection usually secondary to trauma.
Adenovirus Respiratory strains	Respiratory tract infection	ADULT: Routine PEDIATRIC: Droplet and Contact	Respiratory secretions	Large droplets; direct and indirect contact	2-14 days	Until symptoms cease	Duration of illness	Different strains responsible for respiratory and gastrointestinal disease. Minimize exposure of immunocompromised patients, children with chronic cardiac or lung disease, neonates.
	Conjunctivitis	ADULT: Routine PEDIATRIC: Contact	Eye discharge	Direct and indirect contact				
Enteric strains	Diarrhea	ADULT: Routine PEDIATRIC: Contact	Feces	Direct and indirect contact	3-10 days	Until symptoms cease	Until normal stools	Consider Contact precautions for incontinent adults if stool cannot be contained or for adults with poor hygiene who contaminate their environment.
Amebiasis (*Entamoeba histolytica*)	Dysentery	ADULT: Routine PEDIATRIC: Contact	Feces	Direct and indirect contact (fecal/oral)	Days to weeks	Duration of cyst excretion	Duration of illness	
	Abscess		Feces, pus					
Anthrax (*Bacillus anthracis*)	Skin lesions, pneumonia	Routine	Lesion drainage		1-7 days	Not person-to-person		Acquired from infected animals and animal products.
Antimicrobial Resistant Organisms (ARO)	Infection or colonization of any body site	Contact*	Infected or colonized secretions, excretions	Direct and indirect contact	Variable	Variable	As directed by ICP	Includes MRSA, VRE, resistant Gram negative rods and other organisms as per ICP *See ARO, Part B Section I B4.
Arthropod borne virus* (arboviruses)	Encephalitis, fever, rash	Routine		Insectborne	Variable 3-21 days	Not person-to-person		*Several hundred different viruses, most limited to specific geographic areas; in North America: California, St. Louis, Western equine, Eastern equine and Powassan encephalitis viruses and Colorado tick virus are most frequent.
Ascariasis (*Ascaris lumbricoides*) (roundworm)	Usually asymptomatic	Routine			4-8 weeks	Not person-to-person		Ova must hatch in soil to become infective.

Note: Use pediatric precautions for children who are incontinent or too immature to be able to comply with handwashing requirements, appropriate handling and disposal of respiratory secretions, purulent discharges and skin exudates, and maintenance of dressings in place. For older children who are continent and able to comply with precautions for respiratory secretions and skin lesions, precautions for adults may be used.

TABLE 7. Transmission Characteristics and Precautions by Specific Etiology: Recommendations for Acute Care Centres

Microorganism	Clinical presentation	Precautions	Infective material	Route of transmission	Incubation period	Period of communicability	Duration of precautions	Comments
Aspergillosis (*Aspergillus* spp.)	Skin, lung, wound or central nervous system infection	Routine			Variable	Not person-to-person		Spores in dust; infections in immunocompromised patients may be associated with construction.
Astrovirus	Diarrhea	ADULT: Routine* PEDIATRIC: Contact	Feces	Direct and indirect contact (fecal/oral)	3-4 days	Duration of illness	Until normal feces	*Consider Contact precautions for incontinent adults if feces cannot be contained or for adults with poor hygiene who contaminate their environment
Blastomycosis (*Blastomyces dermatitidis*)	Pneumonia, skin lesions	Routine			30-45 days	Not person-to-person		Acquired from spores in soil.
Botulism (*Clostridium botulinum*)	Flaccid paralysis; cranial nerve palsies	Routine		Foodborne	Variable	Not person-to-person		
Brucellosis (*Brucella* sp.)	Undulant or Mediterranean fever	Routine			Weeks to months			Acquired from contact with infected animals or from infected food.
	Draining lesions	Contact*	Drainage from open lesions	Possibly direct contact		Rare cases of person-to-person transmission	Duration of drainage	*Contact precautions required only if wound drainage cannot be contained by dressings.
Burkholderia cepacia	Exacerbation of chronic lung disease in patients with cystic fibrosis	Routine			Variable			Do not place in the same room as a patient with cystic fibrosis (CF) who is not infected or colonized with *Burkholderia cepacia*. Contacts with CF patients in the health care facility who are not colonized or infected with *B. cepacia* should be minimized. Persons with CF who visit or provide care and are not infected or colonized with *B.cepacia* may elect to wear a mask when within 1 metre of a colonized or infected patient who is coughing or undergoing chest physiotherapy.

Note: Use pediatric precautions for children who are incontinent or too immature to be able to comply with handwashing requirements, appropriate handling and disposal of respiratory secretions, purulent discharges and skin exudates, and maintenance of dressings in place. For older children who are continent and able to comply with precautions for respiratory secretions and skin lesions, precautions for adults may be used.

TABLE 7. Transmission Characteristics and Precautions by Specific Etiology: Recommendations for Acute Care Centres

Microorganism	Clinical presentation	Precautions	Infective material	Route of transmission	Incubation period	Period of communicability	Duration of precautions	Comments
Calicivirus (Calicivirus, Norwalk, other small round structural viruses)	Diarrhea	ADULT: Routine* PEDIATRIC: Contact	Feces	Direct and indirect contact (fecal/oral)	12 hours to 4 days	Duration of excretion	Until normal feces	*Consider Contact precautions for incontinent adults if feces cannot be contained or for adults with poor hygiene who contaminate their environment.
Campylobacter jejuni	Diarrhea	ADULT: Routine* PEDIATRIC: Contact	Feces	Direct and indirect contact (fecal/oral)	1-7 days	Duration of excretion	Until feces normal	*Consider Contact precautions for incontinent adults if stool cannot be contained or for adults with poor hygiene who contaminate their environment. Treatment with effective antibiotic shortens period of infectivity.
Candidiasis (*Candida* sp.)	Many	Routine			Variable			Normal flora.
Cat Scratch Disease *Bartonella henselae* (formerly *Rochalimaea henselae*)	Fever, lymphadenopathy	Routine			7-62 days	Not person-to-person		Acquired from animals (cats and others).
Chancroid (*Haemophilus ducreyi*)	Genital ulcers	Routine		Sexually transmitted	3-10 days			
Chickenpox (varicella-zoster virus)	Fever with vesicular rash	Airborne and contact	Lesion drainage, respiratory secretions	Direct and indirect contact; airborne	10-21 days	2 days before rash and until skin lesions have crusted	Until all lesions have crusted and dried	Roommates and caregivers should be immune to chickenpox. Susceptible high-risk contacts should receive VZIG as soon as possible, latest within 96 hours of exposure. VZIG may extend the incubation period to 28 days. Airborne precautions should be taken with neonates born to mothers with varicella onset < 5 days before delivery.
	Susceptible contact	Airborne	Respiratory secretions			Potentially communicable during last 2 days of incubation period	From 8 days after first contact until 21 days after last contact with rash (28 days if given VZIG)	

Note: Use pediatric precautions for children who are incontinent or too immature to be able to comply with handwashing requirements, appropriate handling and disposal of respiratory secretions, purulent discharges and skin exudates, and maintenance of dressings in place. For older children who are continent and able to comply with precautions for respiratory secretions and skin lesions, precautions for adults may be used.

TABLE 7. Transmission Characteristics and Precautions by Specific Etiology: Recommendations for Acute Care Centres

Microorganism	Clinical presentation	Precautions	Infective material	Route of transmission	Incubation period	Period of communicability	Duration of precautions	Comments
Chlamydia trachomatis	Genital tract; neonatal conjuctivitis, pneumonia; trachoma	Routine		Sexually transmitted; mother-to -newborn	Variable			
Cholera (*Vibrio cholerae* 01)	Diarrhea	ADULT: Routine* PEDIATRIC: Contact	Feces	Direct and indirect contact (fecal/oral)	1-5 days	Duration of shedding	Until normal feces	*Consider Contact precautions for incontinent adults if stool cannot be contained or for adults with poor hygiene who contaminate their environment.
Clostridium difficile	Diarrhea, pseudo-membranous colitis	Contact	Feces	Direct and indirect contact (fecal/oral)	Variable	Duration of shedding	Until normal feces for 72 hours	Bacterial spores persist in the environment. Pay special attention to cleaning.
Clostridium perfringens	Food poisoning	Routine		Foodborne	6-24 hours	Not person-to-person		
	Gas gangrene, abscesses, myonecrosis	Routine			Variable	Not person-to-person		Found in normal gut flora, soil. Infection related to devitalized tissue.
Coccidioidomycosis (*Coccidioides immitis*)	Pneumonia, draining lesions	Routine			1-4 weeks	Not person-to-person		Acquired from spores in soil, dust.
Colorado tick fever See arbovirus	Fever	Routine		Tickborne	3-6 days	Not person-to-person		
Congenital rubella See Rubella								
Coronavirus	Common cold	ADULT: Routine PEDIATRIC: Droplet and Contact	Respiratory secretions	Direct and indirect contact. Possible large droplet	2-4 days	Until symptoms cease	Duration of illness	
Coxsackievirus See Enterovirus								

Note: Use pediatric precautions for children who are incontinent or too immature to be able to comply with handwashing requirements, appropriate handling and disposal of respiratory secretions, purulent discharges and skin exudates, and maintenance of dressings in place. For older children who are continent and able to comply with precautions for respiratory secretions and skin lesions, precautions for adults may be used.

TABLE 7. Transmission Characteristics and Precautions by Specific Etiology: Recommendations for Acute Care Centres

Microorganism	Clinical presentation	Precautions	Infective material	Route of transmission	Incubation period	Period of communicability	Duration of precautions	Comments
Creutzfeldt-Jakob disease	Chronic encephalopathy	Routine*	Central nervous system tissues		Months to years			*Special precautions for neurosurgical procedures and autopsy and handling deceased body. Refer to Health Canada *Infection control guidelines for health care workers for Creutzfeldt-Jakob disease in Canada*[344] .
Cryptococcosis (*Cryptococcus neoformans*)	Pneumonia, meningitis, adenopathy	Routine			Unknown	Not person-to-person		Acquired from spores in soil.
Cryptosporidiosis (*Cryptosporidium parvum*)	Diarrhea	ADULT: Routine* PEDIATRIC: Contact	Feces	Direct and indirect contact (fecal/oral)	2-14 days	From onset of symptoms until several weeks after resolution	Until symptoms cease	*Consider Contact precautions for incontinent adults if feces cannot be contained or for adults with poor hygiene who contaminate their environment.
Cysticercosis (*Taenia solium* larvae)	Cysts in various organs	Routine	Ova in feces	Direct contact (fecal/oral)	Months to years			Transmissible only if patient has *Taenia solium* adult tapeworm in gastrointestinal tract (see Tapeworm).
Cytomegalovirus	Usually asymptomatic; congenital infection, retinitis, disseminated infection in immunocompromised host	Routine	Saliva, genital secretions, urine	Sexual contact, direct contact	Unknown			Requires intimate direct personal contact for transmission
Dengue (arbovirus)	Fever, arthralgia, rash	Routine		Mosquito-borne	3-14 days	Not person-to-person		
Dermatophytosis See *Tinea*		Routine						

Note: Use pediatric precautions for children who are incontinent or too immature to be able to comply with handwashing requirements, appropriate handling and disposal of respiratory secretions, purulent discharges and skin exudates, and maintenance of dressings in place. For older children who are continent and able to comply with precautions for respiratory secretions and skin lesions, precautions for adults may be used.

TABLE 7. Transmission Characteristics and Precautions by Specific Etiology: Recommendations for Acute Care Centres

Microorganism	Clinical presentation	Precautions	Infective material	Route of transmission	Incubation period	Period of communicability	Duration of precautions	Comments
Diphtheria (*Corynebacterium diphtheriae*)	Cutaneous (characteristic ulcerative lesion)	Contact	Lesion drainage	Direct or indirect contact	2-5 days	If untreated, 2 weeks to several months	Until two cultures* from skin lesions are negative	*Cultures should be taken at least 24 hours apart and at least 24 hours after cessation of antimicrobial therapy.
	Pharyngeal (adherent grayish membrane)	Droplet	Nasopharyngeal secretions	Large droplets, direct contact	2-5 days		Until two cultures* from both nose and throat are negative	If culture facilities not available, precautions should be taken until at least 2 weeks of appropriate therapy. Close contacts should be given antibiotic prophylaxis.
Ebola	Hemorrhagic fever	Contact plus Droplet (Contact plus Airborne if pneumonia)	Blood and bloody body fluids, respiratory secretions	Direct and indirect contact; possibly airborne if pneumonia	2-21 days	Unknown, possibly several weeks	Until symtpoms resolve	Local public health authorities or regional officer of health and LCDC should be notified immediately. Refer to *Canadian Contingency Plan for Viral Hemorrhagic Fevers and Other Related Diseases*[22]. Special precautions for handling of deceased body.
Echinococcosis (Hydatidosis) (*Echinococcus granulosis, Echinococcus multilocularis*)	Cysts in various organs	Routine			Months to years	Not person-to-person		Acquired from contact with infected animals.
Echovirus (see enterovirus)								
Enterobiasis (*Enterobius vermicularis*), (*oxyuriasis, pinworm*)	Perianal itching	Routine	Ova in perianal region	Direct contact	1-2 months			Close household contacts may need treatment.
Enterococcus species (Vancomycin resistant only) See Vancomycin resistant enterococcus								

Note: Use pediatric precautions for children who are incontinent or too immature to be able to comply with handwashing requirements, appropriate handling and disposal of respiratory secretions, purulent discharges and skin exudates, and maintenance of dressings in place. For older children who are continent and able to comply with precautions for respiratory secretions and skin lesions, precautions for adults may be used.

TABLE 7. Transmission Characteristics and Precautions by Specific Etiology: Recommendations for Acute Care Centres

Microorganism	Clinical presentation	Precautions	Infective material	Route of transmission	Incubation period	Period of communicability	Duration of precautions	Comments
Enteroviral infections Echovirus, coxsackievirus, poliovirus, enterovirus	Acute febrile illness, aseptic meningitis, encephalitis, pharyngitis, herpangina, rash, pleurodynia	ADULT: Routine PEDIATRIC: Contact	Feces, respiratory secretions	Direct and indirect contact	3-6 days		Duration of illness; if poliovirus, see poliomyelitis	
	Conjunctivitis	ADULT: Routine PEDIATRIC: Contact	Eye discharge	Direct and indirect contact	24-72 hours		Duration of illness	
Epstein Barr virus	Infectious mononucleosis	Routine			30-50 days			
Erythema infectiosum See Parvovirus B19								
Escherichia coli (pathogenic strains)	Diarrhea, hemolytic-uremic syndrome, thrombotic thrombocytopenic purpura	ADULT: Routine* PEDIATRIC: Contact	Feces	Direct and indirect contact (fecal/oral)	10 hours to 8 days	Duration of shedding	Until normal feces If HUS: until two stools negative for *E. coli* O157:H7 or 10 days from onset of diarrhea.	*Consider Contact precautions for incontinent adults if feces cannot be contained or for adults with poor hygiene who contaminate their environment.
German measles See Rubella								
Giardia (*Giardia lamblia*)	Diarrhea	ADULT: Routine* PEDIATRIC: Contact	Feces	Direct and indirect contact (fecal/oral)	1-4 weeks	May persist for months	Until normal feces	*Consider Contact precautions for incontinent adults if feces cannot be contained or for adults with poor hygiene who contaminate their environment.
Gonococcus (*Neisseria gonorrhoeae*)	Ophthalmia neonatorum, gonorrhea, arthritis, pelvic inflammatory disease	Routine		Mother-to-newborn Sexually transmitted	2-7 days			

Note: Use pediatric precautions for children who are incontinent or too immature to be able to comply with handwashing requirements, appropriate handling and disposal of respiratory secretions, purulent discharges and skin exudates, and maintenance of dressings in place. For older children who are continent and able to comply with precautions for respiratory secretions and skin lesions, precautions for adults may be used.

TABLE 7. Transmission Characteristics and Precautions by Specific Etiology: Recommendations for Acute Care Centres

Microorganism	Clinical presentation	Precautions	Infective material	Route of transmission	Incubation period	Period of communicability	Duration of precautions	Comments
Granuloma inguinale (Donovanosis) (*Calymmatobacterium granulomatis*)	Painless genital ulcers, inguinal ulcers, nodules	Routine		Sexually transmitted	8-20 days			
***Haemophilus influenzae* type b** (invasive disease)	Pneumonia, epiglottitis, meningitis, bacteremia, septic arthritis, cellulitis	ADULT: Routine PEDIATRIC: Droplet	Respiratory secretions	Large droplets, direct contact	Variable	Most infectious in the week prior to onset of illness and during the illness until treated	Until 24 hours of appropriate antibiotic therapy has been received	Close contacts < 48 months old and who are not immune may require chemoprophylaxis. Household contacts of such children should also receive prophylaxis.
Hantavirus	Fever, pneumonia	Routine		Rodents	Variable	Not person-to-person		Infection acquired from rodents.
Helicobacter pylori	Gastritis, ulcer	Routine		Unknown	Unknown			Disinfection of gastroscopes
Hepatitis A, E	Hepatitis, anicteric acute febrile illness	ADULT: Routine* PEDIATRIC: Contact	Feces	Direct and indircet contact (fecal/oral)	A: 15-50 days E: 15-60 days	A: Two weeks before to 1 week after onset of symptoms; shedding is prolonged in the newborn. E: fecal shedding at least 2 weeks	1 week after onset of symptoms; duration of hospitalization if newborn	*Consider Contact precautions for incontinent adults if feces cannot be contained or for adults with poor hygiene who contaminate their environment. Post-exposure prophylaxis indicated for non-immune contacts with significant exposure to hepatitis A if within 2 weeks of exposure.
Hepatitis B, C, D and other unspecified non-A, non-B	Hepatitis, often asymptomatic	Routine	Blood and certain other body fluids*	Mucosal or percutaneous exposure to infective body fluids	weeks to years	From onset of infection		Routine incorporates bloodborne pathogen precautions. *Refer to *Preventing the Transmission of Bloodborne Pathogens in Health Care and Public Services Settings*[21]

Note: Use pediatric precautions for children who are incontinent or too immature to be able to comply with handwashing requirements, appropriate handling and disposal of respiratory secretions, purulent discharges and skin exudates, and maintenance of dressings in place. For older children who are continent and able to comply with precautions for respiratory secretions and skin lesions,

TABLE 7. Transmission Characteristics and Precautions by Specific Etiology: Recommendations for Acute Care Centres

Microorganism	Clinical presentation	Precautions	Infective material	Route of transmission	Incubation period	Period of communicability	Duration of precautions	Comments
Herpes simplex	Encephalitis	Routine						
	Neonatal	Contact	Skin or mucosal lesions; possibly all body secretions and excretions	Direct contact	Birth to 6 weeks of age		Duration of illness	Contact precautions are also indicated for infants delivered vaginally (or by C-section if membranes have been ruptured more than 4-6 hours) to women with active genital HSV infections, until neonatal HSV infection has been ruled out.
	Mucocutaneous: disseminated or primary and extensive	Contact	Skin or mucosal lesions	Direct contact	2 days to 2 weeks	While lesions present	Until lesions resolve	
	Recurrent	Routine						
Herpes zoster Disseminated	Vesicular skin lesions	Airborne and Contact	Vesicle fluid, respiratory secretions	Airborne, direct and indirect contact		Until all lestions have crusted and dried	Until all lesions have crusted and dried	Room-mates and caregivers should be immune to chickenpox. Susceptible high-risk contacts should be given VZIG as soon as possible, latest within 96 hours of exposure. For susceptible contacts airborne precautions should begin 8 days after first exposure to rash and continue until 21 days after last exposure (28 days if VZIG given).
Localized: Immunocompro-mised host	Vesicular skin lesions in dermatomal distribution	Airborne and Contact	Vesicle fluid	Direct and indirect contact, airborne		Until all lesions have crusted and dried	Until 24 hours after antiviral therapy started; then as for localized zoster in normal host	Localized zoster may disseminate in immunocompromised host if not treated.
Localized: Normal host	Vesicular skin lesions in dermatomal distribution	Routine or airborne and contact*	Vesicle fluid	Direct and indirect contact, possibly airborne		Until all lesions have crusted and dried	Until all lesions have crusted and dried	*Consider for cases of extensive localized zoster that cannot be covered, in situations where there are varicella susceptible patients.

Note: Use pediatric precautions for children who are incontinent or too immature to be able to comply with handwashing requirements, appropriate handling and disposal of respiratory secretions, purulent discharges and skin exudates, and maintenance of dressings in place. For older children who are continent and able to comply with precautions for respiratory secretions and skin lesions, precautions for adults may be used.

TABLE 7. Transmission Characteristics and Precautions by Specific Etiology: Recommendations for Acute Care Centres

Microorganism	Clinical presentation	Precautions	Infective material	Route of transmission	Incubation period	Period of communicability	Duration of precautions	Comments
Histoplasmosis (*Histoplasma capsulatum*)	Pneumonia, lymphadenopathy, fever	Routine			Variable	Not person-to-person		Acquired from spores in soil.
Hookworm (*Necator americanus*, *Ancyclostoma duodenale*)	Usually asymptomatic	Routine			4-6 weeks	Not person-to-person		Larvae must hatch in soil to become infectious.
Human herpesvirus 6 (HHV-6) See Roseola								
Human Immunodeficiency virus (HIV)	Asymptomatic; multiple clinical presentations	Routine	Blood and certain other body fluids*	Mucosal or percutaneous exposure to infective body fluids	Weeks to years	From onset of infection		Routine incorporates bloodborne pathogen precautions. *Refer to *Preventing the Transmission of Bloodborne Pathogens in Health Care and Public Services Settings*[21]
Human T-cell leukemia virus, human T-lymphotrophic virus (HTLV-I, HTLV-II)	Asymptomatic	Routine	Blood and certain other body fluids*	Mucosal or percutaneous exposure to infective body fluids	Weeks to years	From onset of infection		Routine incorporates bloodborne pathogen precautions. *Refer to *Preventing the Transmission of Bloodborne Pathogens in Health Care and Public Services Settings*[21]
Influenza	Respiratory tract infection	ADULT: Droplet and Contact (optional)* PEDIATRIC: Droplet and Contact	Respiratory secretions	Large droplets, direct and indirect contact (possibly airborne)	1-3 days	7 days (shedding may be longer in infants)	For duration of illness	*Although it is thought that influenza is transmitted by large droplet and contact routes, it is controversial as to whether or not additional precautions are needed. If private room is unavailable, consider cohorting patients during outbreaks. Patient should not share room with high risk patients. Minimize exposure of immunocompromised patients, children with chronic cardiac or lung disease, neonates.

Note: Use pediatric precautions for children who are incontinent or too immature to be able to comply with handwashing requirements, appropriate handling and disposal of respiratory secretions, purulent discharges and skin exudates, and maintenance of dressings in place. For older children who are continent and able to comply with precautions for respiratory secretions and skin lesions, precautions for adults may be used.

TABLE 7. Transmission Characteristics and Precautions by Specific Etiology: Recommendations for Acute Care Centres

Microorganism	Clinical presentation	Precautions	Infective material	Route of transmission	Incubation period	Period of communicability	Duration of precautions	Comments
Lassa fever	Hemorrhagic fever	Contact plus Droplet (Contact plus Airborne if pneumonia)	Blood and bloody body fluids, respiratory secretions, possibly urine and stool	Direct and indirect contact (possibly airborne if pneumonia)	6-21 days	Until 3-9 weeks after onset	Duration of viral shedding	Local public health authorities or regional officer of health and LCDC should be notified immediately. Refer to *Canadian Contingency Plan for Viral Hemorrhagic Fevers and Other Related Diseases*[22] Special handling of deceased body.
Legionella (*Legionella* spp)	Pneumonia	Routine			2-10 days	Not person-to-person		Acquired from contaminated water.
Leprosy (Hansen's disease) (*Mycobacterium leprae*)	Chronic disease of skin, nerves, nasopharyngeal mucosa	Routine	Nasal secretions	Direct contact	One to many years			Transmitted between persons only with very prolonged extensive close personal contact. Household contacts should be given prophylaxis.
Leptospirosis (*Leptospira* sp.)	Fever, jaundice, aseptic meningitis	Routine			2-26 days	Not person-to-person		Acquired from contact with animals.
Lice (pediculosis) (*Pediculus humanus*, *Phthirus pubis*)	Scalp or body itch, itchy rash	Routine plus gloves for direct patient contact only	Louse	Direct and indirect contact	6-10 days	Until effective treatment to kill lice and ova	Until 24 hours after initiation of appropriate treatment	Apply pediculicides as directed on label. If live lice found after therapy, repeat. Head lice: Wash headgear, combs, pillow cases, towels with hot water or dry clean or seal in plastic bag and store for 10 days. Body lice: As above, for all exposed clothing and bedding.
Listeriosis (*Listeria monocytogenes*)	Fever, meningitis Congenital or neonatal infection	Routine		Foodborne Mother-to fetus or newborn	Mean 21 days			Nosocomial outbreaks reported in newborn nurseries.
Lyme disease (*Borrelia burgdorferi*)	Fever, arthritis, rash, meningitis	Routine		Tickborne	Rash: 3-31 days	Not person-to-person		
Lymphocytic choriomeningitis virus	Aseptic meningitis	Routine			6-21 days	Not person-to-person		Acquired from contact with rodents.

Note: Use pediatric precautions for children who are incontinent or too immature to be able to comply with handwashing requirements, appropriate handling and disposal of respiratory secretions, purulent discharges and skin exudates, and maintenance of dressings in place. For older children who are continent and able to comply with precautions for respiratory secretions and skin lesions, precautions for adults may be used.

TABLE 7. Transmission Characteristics and Precautions by Specific Etiology: Recommendations for Acute Care Centres

Microorganism	Clinical presentation	Precautions	Infective material	Route of transmission	Incubation period	Period of communicability	Duration of precautions	Comments
Lymphogranuloma venereum (*Chlamydia trachomatis*)	Genital ulcers, inguinal adenopathy	Routine		Sexually transmitted	Variable			
Malaria (*Plasmodium* sp.)	Fever	Routine	Blood	Mosquito-borne	Variable	Not normally person-to-person		Can be transmitted via blood transfusion.
Marburg virus	Hemorrhagic fever	Contact plus Droplet (Contact plus Airborne if pneumonia)	Blood and bloody body fluids; respiratory secretions	Direct and indirect contact; possibly airborne if pneumonia	3-9 days	Duration of virus shedding	Until symptoms resolve	Local public health authorities or regional officer of health and LCDC should be notified immediately. Refer to *Canadian Contingency Plan for Viral Hemorrhagic Fevers and Other Related Diseases*[12] Special handling of deceased body.
Measles (Rubeola)	Fever, coryza, maculopapular skin rash	Airborne	Respiratory secretions	Airborne	7-18 days	5 days before onset of rash (1-2 days before onset of initial symptoms) until 4 days after onset of rash (longer in immunocompromised patients)	4 days after start of rash; duration of illness in immunocompromised patients	Only immune personnel and caretakers should enter the room. Immunoprophylaxis is indicated for susceptible contacts. Precautions should be taken with neonates born to mothers with measles infection at delivery.
	Susceptible contact	Airborne	Respiratory secretions	Airborne		Potentially communicable during last 2 days of incubation period	From 5 days after first exposure through 21 days after last exposure	
Melioidosis (*Pseudomonas pseudomallei*)	Pneumonia, fever	Routine			Variable	Unknown		Organism in soil in South-East Asia. Rare cases of person-to-person transmission.
Meningococcus (*Neisseria meningitidis*)	Meningococcemia, meningitis, pneumonia	Droplet	Respiratory secretions	Large droplet, direct contact	Usually 2-10 days	Until 24 hours of effective therapy has been received	Until 24 hours of appropriate antibiotic therapy received	Close contacts may require chemopropylaxis.

Note: Use pediatric precautions for children who are incontinent or too immature to be able to comply with handwashing requirements, appropriate handling and disposal of respiratory secretions, purulent discharges and skin exudates, and maintenance of dressings in place. For older children who are continent and able to comply with precautions for respiratory secretions and skin lesions, precautions for adults may be used.

TABLE 7. Transmission Characteristics and Precautions by Specific Etiology: Recommendations for Acute Care Centres

Microorganism	Clinical presentation	Precautions	Infective material	Route of transmission	Incubation period	Period of communicability	Duration of precautions	Comments
Methicillin resistant *S. aureus* (MRSA) See ARO								
Molluscum contagiosum	Umbilicated papules	Routine	Contents of papules	Direct contact	2 weeks to 6 months	Unknown		Requires intimate direct personal contact for transmission.
Mucormycosis (*phycomycosis; zygomycosis*) (*Mucor, Zygomycetes*)	Skin, wound, rhinocerebral infection	Routine			Unknown	Not person-to-person		Acquired from sores in dust, soil.
Mumps	Swelling of salivary glands, orchitis	Droplet	Saliva	Large droplets, direct contact	12-25 days	2 days before to 9 days after onset	Until 9 days after onset of swelling	Droplet precautions for exposed susceptible patients should begin 10 days after first contact and continue through 26 days after last exposure.
Mycobacterium non-tuberculosis (atypical) (*Mycobacterium avium* complex)	Lymphadenitis; pneumonia; disseminated disease in immunocompromised host	Routine			Unknown	Not person-to-person		Acquired from soil, water, animal, reservoirs.
Mycobacterium tuberculosis (*also Mycobacterium africanum, Mycobacterium bovis*)	Confirmed or suspected pulmonary, laryngeal	Airborne*	Respiratory secretions	Airborne	Weeks to years	While organisms in sputum	Until patient has received two weeks of effective therapy, is improving clinically, and has three consecutive negative sputum smears collected at least 24 hours apart. If multi-drug resistant tuberculosis, until culture negative	*Refer to *Guidelines for Preventing the Transmission of Tuberculosis in Canadian Health Care Facilities and Other Institutional Settings*[20] Tuberculosis in young children is rarely contagious; assess visiting family members for cough.

Note: Use pediatric precautions for children who are incontinent or too immature to be able to comply with handwashing requirements, appropriate handling and disposal of respiratory secretions, purulent discharges and skin exudates, and maintenance of dressings in place. For older children who are continent and able to comply with precautions for respiratory secretions and skin lesions, precautions for adults may be used.

TABLE 7. Transmission Characteristics and Precautions by Specific Etiology: Recommendations for Acute Care Centres

Microorganism	Clinical presentation	Precautions	Infective material	Route of transmission	Incubation period	Period of communicability	Duration of precautions	Comments
Mycobacterium tuberculosis (Cont'd)	Extra-pulmonary: meningitis, bone, joint infection, draining lesions	Routine						Assess for concurrent pulmonary tuberculosis. Avoid procedures that may generate aerosols from drainage.
	PPD skin test positive with no evidence of current pulmonary disease	Routine						
Mycoplasma pneumoniae	Pneumonia	ADULT: Routine PEDIATRIC: Droplet	Respiratory secretions	Large droplets, direct contact	1-4 weeks	Unknown	Duration of illness	
Neisseria gonorrhoeae See Gonococcus								
Neisseria meningitidis See Meningococcus								
Nocardiosis (*Nocardia* sp.)	Fever, pulmonary or CNS infection	Routine			Unknown	Not person-to-person		Acquired from organisms in dust, soil.
Norwalk agent See Caliciviruses								
Orf (poxvirus)	Skin lesions	Routine			Variable	Not person-to-person		Acquired from infected animals.
Parainfluenza virus	Respiratory tract infection	ADULT: Routine PEDIATRIC: Contact and Droplet	Respiratory secretions	Direct and indirect contact, large droplets	2-6 days	1-3 weeks	Duration of illness	May cohort if infected with same virus. Minimize exposure of immunocompromised patients, children with chronic cardiac or lung disease, neonates.
Parvovirus B-19	*Erythema infectiosum* (fifth disease), aplastic crisis	Fifth disease: Routine Aplastic crisis: Droplet	Respiratory secretions	Large droplets, direct contact	4-21 days	Fifth disease: no longer infectious by the time the rash appears	Aplastic crisis: see comments	For patients with transient aplastic or erythrocyte crisis, precautions should be maintained for 7 days. For immunosuppressed patients with chronic infection, maintain for duration of hospitalization.

Note: Use pediatric precautions for children who are incontinent or too immature to be able to comply with handwashing requirements, appropriate handling and disposal of respiratory secretions, purulent discharges and skin exudates, and maintenance of dressings in place. For older children who are continent and able to comply with precautions for respiratory secretions and skin lesions, precautions for adults may be used.

TABLE 7. Transmission Characteristics and Precautions by Specific Etiology: Recommendations for Acute Care Centres

Microorganism	Clinical presentation	Precautions	Infective material	Route of transmission	Incubation period	Period of communicability	Duration of precautions	Comments
Pediculosis See lice								
Pertussis (*Bordetella pertussis*)	Whooping cough, non specific respiratory tract infection in infants	Droplet	Respiratory secretions	Large droplets	6-20 days	To 3 weeks after onset of paroxysms if not treated	To 3 weeks after onset of paroxysms if not treated; or until 5 days of appropriate antibiotic therapy received	Close contacts may need chemoprophylaxis.
Phycomycosis See Mucormycosis								
Pinworms See *Enterobius*		Routine						
Plague (*Yersinia pestis*)	Bubonic (lymphadenitis)	Routine			2-6 days			
	Pneumonic (cough, fever, hemoptysis)	Droplet	Respiratory secretions	Large droplets	2-4 days	Until 72 hours of appropriate antibiotic therapy received	Until 72 hours of appropriate antibiotic therapy received	Close contacts may require prophylaxis.
Pneumocystis carinii	Pneumonia in immunocompromised host	Routine		Unknown	Unknown			Ensure room-mates not immunocompromised.
Poliomyelitis See Enterovirus	Flaccid paralysis	Contact	Feces, respiratory secretions	Direct and indirect contact	3-21 days	Duration of shedding up to 6 weeks	Until 6 weeks from onset of illness or feces culture negative	Close contacts who are not immune should receive immunoprophylaxis.
Pseudomonas cepacea See *Burkholderia cepacia*								
Psittacosis (*Chlamydia psittaci*) (ornithosis)	Pneumonia, fever	Routine			7-14 days	Not person-to-person		Acquired from contact with infected birds.

Note: Use pediatric precautions for children who are incontinent or too immature to be able to comply with handwashing requirements, appropriate handling and disposal of respiratory secretions, purulent discharges and skin exudates, and maintenance of dressings in place. For older children who are continent and able to comply with precautions for respiratory secretions and skin lesions, precautions for adults may be used.

TABLE 7. Transmission Characteristics and Precautions by Specific Etiology: Recommendations for Acute Care Centres

Microorganism	Clinical presentation	Precautions	Infective material	Route of transmission	Incubation period	Period of communicability	Duration of precautions	Comments
Q Fever (*Coxiella burnetii*)	Pneumonia, fever	Routine			14-39 days	Not person-to-person		Acquired from contact with infected animals or from raw milk.
Rabies	Rabies	Routine	Saliva	Mucosal or percutaneous exposure to saliva	5 days to several months	Person-to-person not documented		Acquired from contact with infected animals. Post-exposure prophylaxis recommended for percutaneous or mucosal contamination with saliva of rabid animal or patient.
Rat bite fever *Streptobacillus moniliformis; Spirillum minus*	Fever, arthralgia	Routine			*S. moniliformis* 3-21 days; *S. minus* 7-21 days	Not person-to-person		*S. moniliformis:* rats and other animals, contaminated milk. *S. minus*: rats, mice only.
Respiratory syncytial virus (RSV)	Respiratory tract infection	ADULT: Routine PEDIATRIC: Contact and Droplet	Respiratory secretions	Direct and indirect contact, large droplets	2-8 days	Until symptoms cease	Duration of symptoms	May cohort if infected with same virus. Minimize exposure of immunocompromised patients, children with chronic cardiac or lung disease, neonates.
Rhinovirus	Respiratory tract infection, common cold	ADULT: Routine PEDIATRIC: Contact and Droplet	Respiratory secretions	Direct and indirect contact, possibly large droplets	2-3 days	Until symptoms cease	Duration of illness	
Rickettsialpox *Rickettsia akari*	Fever, rash	Routine		Miteborne	9-14 days	Not person-to-person		Transmitted by mouse mites.
Ringworm See *Tinea*		Routine						
Ritters disease See Staphylococcal scalded skin syndrome								
Rocky Mountain spotted fever *Rickettsia rickettsii*	Fever, petechial rash, encephalitis	Routine		Tickborne	2-14 days	Not person-to-person		

Note: Use pediatric precautions for children who are incontinent or too immature to be able to comply with handwashing requirements, appropriate handling and disposal of respiratory secretions, purulent discharges and skin exudates, and maintenance of dressings in place. For older children who are continent and able to comply with precautions for respiratory secretions and skin lesions, precautions for adults may be used.

TABLE 7. Transmission Characteristics and Precautions by Specific Etiology: Recommendations for Acute Care Centres

Microorganism	Clinical presentation	Precautions	Infective material	Route of transmission	Incubation period	Period of communicability	Duration of precautions	Comments
Roseola Infantum (Human herpesvirus 6)	Rash, fever	Routine	Saliva (presumed)	Direct contact	9-10 days			Transmission requires intimate direct personal contact.
Rotavirus	Diarrhea	ADULT: Routine* PEDIATRIC: Contact	Feces	Direct and indirect contact	1-3 days	Duration of illness	Duration of illness, minimum of 7 days†	*Consider Contact precautions for incontinent adults if feces cannot be contained or for adults with poor hygiene who contaminate their environment. †Prolonged fecal shedding may occur in immunocompromised patients after recovery; Contact precautions for duration of hospitalization may be justified.
Roundworm See Ascariasis								
Rubella Acquired	Fever, maculopapular rash	Droplet	Respiratory secretions	Large droplets, direct contact	14-21 days	Few days before to 7 days after onset of rash	Until 7 days after onset of rash	Droplet precautions should be maintained for exposed susceptible patients for 7 days after first contact through to 21 days after last contact.
Congenital	Congenital rubella syndrome	Droplet and contact	Respiratory secretions, urine	Direct and indirect contact; large droplets		Prolonged shedding in respiratory tract and urine; can be up to one year	Until one year of age, unless nasopharyngeal and urine cultures done after 3 months of age are negative	
Rubeola See Measles								
Salmonella (including *Salmonella typhi*)	Diarrhea, enteric fever, typhoid fever	ADULT: Routine* PEDIATRIC: Contact	Feces	Contact (fecal/oral), foodborne	Diarrhea: 6-72 hours; enteric fever: 3-60 days	Variable	Until normal feces	*Consider Contact precautions for incontinent adults if feces cannot be contained or for adults with poor hygiene who contaminate their environment.

Note: Use pediatric precautions for children who are incontinent or too immature to be able to comply with handwashing requirements, appropriate handling and disposal of respiratory secretions, purulent discharges and skin exudates, and maintenance of dressings in place. For older children who are continent and able to comply with precautions for respiratory secretions and skin lesions, precautions for adults may be used.

TABLE 7. Transmission Characteristics and Precautions by Specific Etiology: Recommendations for Acute Care Centres

Microorganism	Clinical presentation	Precautions	Infective material	Route of transmission	Incubation period	Period of communicability	Duration of precautions	Comments
Scabies (*Sarcoptes scabiei*)	Itchy skin rash	Contact*	Mite	Direct and indirect contact	4-6 weeks. If re-infected, 1-4 days.	Until 24 hours after initiation of appropriate therapy	Until 24 hours after initiation of appropriate therapy	*For extensive or Norwegian (crusted) scabies only. For typical scabies, use gloves and gown for direct patient contact only; otherwise, Routine. Apply scabicide as directed on label. Wash clothes and bedding in hot water, dry clean or seal in a plastic bag, and store for 1 week. Household contacts should be treated.
Schistosomiasis (bilharziasis) (*Schistosoma* sp.)	Diarrhea, fever, itchy rash Hepatosplenomegaly, hematuria	Routine			Unknown	Not person-to-person		Contact with larvae in contaminated water.
Shigella	Diarrhea	ADULT: Routine* PEDIATRIC: Contact	Feces	Direct and indirect contact (fecal/oral)	1-7 days	Usually 4 weeks if not treated	Until normal feces	*Consider Contact precautions for incontinent adults if feces cannot be contained or for adults with poor hygiene who contaminate their environment. Treatment with effective antibiotic shortens period of infectivity.
Shingles See Herpes zoster								
Small round-structured viruses See Caliciviruses								
Sporotrichosis *Sporothrix schenckii*	Skin lesions, disseminated	Routine			Variable	Not person-to-person		Acquired from spores in soil, on vegetation.

Note: Use pediatric precautions for children who are incontinent or too immature to be able to comply with handwashing requirements, appropriate handling and disposal of respiratory secretions, purulent discharges and skin exudates, and maintenance of dressings in place. For older children who are continent and able to comply with precautions for respiratory secretions and skin lesions, precautions for adults may be used.

TABLE 7. Transmission Characteristics and Precautions by Specific Etiology: Recommendations for Acute Care Centres

Microorganism	Clinical presentation	Precautions	Infective material	Route of transmission	Incubation period	Period of communicability	Duration of precautions	Comments
Staphylococcus aureus If methicillin-resistant, also see ARO If vancomycin-resistant, see text Part B, Section IB4	Wound or burn infection, skin infection, impetigo, scalded skin syndrome (Ritters disease)	Minor: Routine Major: Contact	Drainage, skin exudates	Direct or indirect contact	Variable	As long as organism is in the exudate/drainage	Until drainage resolved or contained by dressings	Major = drainage not contained by dressings.
	Pneumonia	Routine*		Possibly droplet				*Transmissibility and need for masks controversial. Consider mask for close contact until 24-48 hours of antibiotic received.
	Toxic shock syndrome	Routine						
***Streptococcus* gr A** (*Streptococcus pyogenes*)	Wound or burn infection, skin infection, impetigo, cellulitis, necrotizing fasciitis, myositis, endometritis	Minor: Routine* Major: Contact*	Drainage, skin exudates	Direct and indirect contact	Variable	As long as organism is in the exudate/drainage	Until 24 hours of appropriate antibiotic therapy received	Major = drainage not contained by dressings. Chemoprophylaxis may be indicated for close contacts of patients with invasive disease or toxic shock syndrome (controversial). *Need for masks controversial. Consider using Droplet precautions for all patients with invasive disease until 24 hours of antibiotic received.
	Pneumonia	ADULT: Routine* PEDIATRIC: Droplet	Respiratory secretions	Large droplets, direct contact	Variable			
	Scarlet fever, pharyngitis	ADULT: Routine PEDIATRIC: Droplet	Respiratory secretions	Large droplets	2-5 days	10-21 days		
	Toxic shock syndrome	Routine						
***Streptococcus* gr B** (*Streptococcus agalactiae*)	Sepsis, meningitis	Routine			Variable			Normal flora.
Streptococcus pneumoniae	Multiple	Routine			Variable			Normal flora.
Strongiyoides (*Strongiyoides stercoralis*)	Usually asymptomatic	Routine	Larvae in feces		Unknown	Rarely transmitted person-to-person		Infective larvae in soil. May cause disseminated disease in immunocompromised patient.

Note: Use pediatric precautions for children who are incontinent or too immature to be able to comply with handwashing requirements, appropriate handling and disposal of respiratory secretions, purulent discharges and skin exudates, and maintenance of dressings in place. For older children who are continent and able to comply with precautions for respiratory secretions and skin lesions, precautions for adults may be used.

TABLE 7. Transmission Characteristics and Precautions by Specific Etiology: Recommendations for Acute Care Centres

Microorganism	Clinical presentation	Precautions	Infective material	Route of transmission	Incubation period	Period of communicability	Duration of precautions	Comments
Syphilis *(Treponema pallidum)*	Genital, skin or mucosal lesions, disseminated disease	Routine	Genital secretions, lesion exudates	Sexual Mother-to-fetus or newborn	10-90 days			Requires intimate direct personal contact for transmission.
Tapeworm *Taenia saginata, Taenia solium Diphyllobothrium latum*	Usually asymptomatic	Routine		Foodborne	Variable	Not transmissible person-to-person		Consumption of larvae in raw or undercooked beef or pork or raw fish; larvae develop into adult tapeworms in gastrointestinal tract.
Hymenolepsis nana			Ova in feces	Direct contact (fecal/oral)	2-4 weeks	While ova in feces		
Tetanus *Clostridium tetani*	Tetanus	Routine			2 days - 2 months	Not person-to-person		Acquired from spores in soil which germinate in wounds, devitalized tissue.
Tinea (dermatophytes) *Trichophyton, Microsporum, Epidermophyton, Malassezia furfur*	Ringworm, athlete's foot, pityriasis versicolor	Routine	Organism in skin or hair	Direct contact	Unknown	While lesion present		May be acquired from animals, close person-to-person contact, shared combs, brushes, sheets.
Toxocariasis (*Toxocara canis, Toxocara cati*)	Fever, wheeze, rash, eosinophilia	Routine	Ova in dog/ cat feces		Unknown	Not person-to-person		Acquired from contact with dogs, cats.
Toxoplasmosis (*Toxoplasma gondii*)	Asymptomatic or fever, lymphadenopathy; retinitis, encephalitis in immunocompromised host; congenital infection	Routine			7-21 days	Not person-to-person except mother-to-fetus		Acquired by contact with infected felines or soil contaminated by felines, consumption of raw meat, contaminated raw vegetables or contaminated water.
Trachoma See *Chlamydia trachomatis*								
Trichinosis (*Trichinella spiralis*)	Fever, rash, diarrhea	Routine			1-2 weeks	Not person-to-person		Acquired from consumption of infected meat.

Note: Use pediatric precautions for children who are incontinent or too immature to be able to comply with handwashing requirements, appropriate handling and disposal of respiratory secretions, purulent discharges and skin exudates, and maintenance of dressings in place. For older children who are continent and able to comply with precautions for respiratory secretions and skin lesions, precautions for adults may be used.

TABLE 7. Transmission Characteristics and Precautions by Specific Etiology: Recommendations for Acute Care Centres

Microorganism	Clinical presentation	Precautions	Infective material	Route of transmission	Incubation period	Period of communicability	Duration of precautions	Comments
Trichomoniasis (*Trichomonas vaginalis*)	Vaginitis	Routine		Sexually transmitted	4-28 days			
Trichuriasis (whipworm) (*Trichuris trichiura*)	Abdominal pain, diarrhea	Routine			Unknown	Not person-to-person		Ova must hatch in soil to be infective.
Tuberculosis See *Mycobacterium tuberculosis*								
Tularemia (*Francisella tularensis*)	Fever, lymphadenopathy, pneumonia	Routine			1-21 days	Not person-to-person		Acquired form contact with infected animals.
Typhoid / parathyphoid fever See *Salmonella*								
Typhus fever (*Rickettsia typhi, Rickettsia prowazekii*)	Fever, rash	Routine		Insectborne	6-14 days			Endemic - fleas. Epidemic - lice.
Vancomycin-resistant enterococcus (VRE)	Infection or colonization of any body site	Contact	Infected or colonized secretions, excretions	Direct and indirect contact	Variable	Duration of colonization	As directed by ICP	Enterococci persist in the environment. Pay special attention to cleaning. See ARO Part B Section IB4.
Vancomycin-resistant *Staphylococcus aureus* (VRSA)	Infection or colonization of any body site	Contact	Infected or colonized secretions, excretions	Direct and indirect contact	Variable	Duration of colonization	As directed by ICP	Local public health authorities or regional officer of health and LCDC should be notified immediately. See text Part B Section IB4.
Varicella See Chickenpox								
Vibrio parahaemolyticus	Diarrhea, wound infections	Routine		Foodborne	Diarrhea: 5-92 hours	Probably not person-to-person		
Whipworm See Trichuriasis								

Note: Use pediatric precautions for children who are incontinent or too immature to be able to comply with handwashing requirements, appropriate handling and disposal of respiratory secretions, purulent discharges and skin exudates, and maintenance of dressings in place. For older children who are continent and able to comply with precautions for respiratory secretions and skin lesions, precautions for adults may be used.

TABLE 7. Transmission Characteristics and Precautions by Specific Etiology: Recommendations for Acute Care Centres

Microorganism	Clinical presentation	Precautions	Infective material	Route of transmission	Incubation period	Period of communicability	Duration of precautions	Comments
Whooping cough See Pertussis								
Yersinia enterocolitica*; *Y. pseudo-tuberculosis	Diarrhea	ADULT: Routine* PEDIATRIC: Contact	Feces	Direct and indirect contact, foodborne	1-14 days	Duration of excretion in stool	Until normal feces	*Consider Contact precautions for incontinent adults if feces cannot be contained or for adults with poor hygiene who contaminate their environment.
Zoster See Herpes zoster								
Zygomycosis See Mucormycosis								

References

1. Jackson M, Lynch P. *Isolation practices: a historical perspective.* Am J Infect 1985;13:21-31.
2. Centers for Disease Control and Prevention. *Isolation techniques for use in hospitals.* 2nd ed. Washington: US Government, 1975.
3. Garner JS, Simmons BP. *Guideline for isolation precautions in hospitals.* Infect Control 1983;4:245-325.
4. Schaffner W. *Infection control: old myths and new realities.* Infect Control 1980;1:330-34.
5. Goldmann DA. *The role of barrier precautions in infection control.* J Hosp Infect 1991;18 (Suppl A):515-23.
6. Haley RW, Garner JS, Simmons BP. *A new approach to the isolation of hospitalized patients with infectious diseases: alternative systems.* J Hosp Infect 1985;6:128-39.
7. *Needlestick transmission of HTLV-III from a patient infected in Africa.* Lancet 1984;2:1376-77.
8. CDC. *Recommendations for prevention of HIV transmission in health-care settings.* MMWR 1987;36:S1-118.
9. CDC. *Update: universal precautions for prevention of transmission of human immunodeficiency virus, hepatitis B virus and other bloodborne pathogens in health-care settings.* MMWR 1988;37:377-88.
10. Lynch P, Jackson MM, Cummings MJ et al. *Rethinking the role of isolation practices in the prevention of nosocomial infections.* Ann Intern Med 1987;107:243-46.
11. Lynch P, Cummings JM, Roberts PL et al. *Implementing and evaluating a system of generic infection precautions: body substance isolation.* Am J Infect Control 1990;18:1-12.
12. Jackson MM, Lynch P. *An attempt to make an issue less murky: a comparison of four systems for infection precautions.* Infect Control Hosp Epidemiol 1991;12:448-50.
13. Garner JS, Hughes JM. *Options for isolation precautions.* Ann Intern Med 1987;107:248-50.
14. Garner JS, HICPAC. *Guideline for isolation precautions in hospitals.* Am J Infect Control 1996;24:24-52.
15. Health and Welfare Canada. *Infection control guidelines for isolation and precaution techniques.* Ottawa, 1990.
16. Health and Welfare Canada. *Recommendations for prevention of HIV transmission in health-care settings.* CDWR 1987;13S3:1-10.

17. Health and Welfare Canada. *Update: universal precautions for prevention of transmission of human immunodeficiency virus, hepatitis B and other bloodborne pathogens in health-care settings.* CDWR 1988;14:117-24.

18. Health and Welfare Canada. *Universal precautions: report of a consensus committee meeting.* CDWR 1989;15:23-28.

19. Health Canada. *Infection control guidelines for long-term care facilities.* Ottawa, 1994.

20. Health Canada. *Guidelines for preventing the transmission of tuberculosis in Canadian health care facilities and other institutional settings.* CCDR 1996;22S1:1-50.

21. Health Canada. *Infection control guidelines: preventing the transmission of bloodborne pathogens in health care and public services settings.* CCDR 1997;23S3:1-42.

22. Health Canada. *Canadian contingency plan for viral hemorrhagic fevers and other related diseases.* CCDR 1997;23S1:1-13.

23. Health Canada. *Infection control guidelines: preventing the spread of vancomycin-resistant enterococci (VRE) in Canada.* CCDR 1997;23S8:1/i-1/16.

24. Archibald L, Phillips L, Monnet D et al. *Antimicrobial resistance in isolates from inpatients and outpatients in the United States: increasing importance of the intensive care unit.* Clin Infect Dis 1997;24:211-15.

25. Shaughnessy PW, Kramer AM. *The increased needs of patients in nursing homes and patients receiving home health care.* N Engl J Med 1990;322:21-7.

26. Smith PW, Rusnak PG. *Infection prevention and control in the long-term-care facility.* Am J Infect Control 1997;25:488-512.

27. Nicolle LE, Strausbaugh LJ, Garibaldi RA. *Infections and antibiotic resistance in nursing homes.* Clin Microbiol Rev 1996;9:1-17.

28. Martone WJ, Jarvis WR, Edwards JR et al. *Incidence and nature of endemic and epidemic nosocomial infections.* In: Bennett JV, Brachman PS, eds. *Hospital infections.* 4th ed. Philadelphia: Lippincott-Raven Publishers, 1998:461-76.

29. Greene JN. *The microbiology of colonization, including techniques for assessing and measuring colonization.* Infect Control Hosp Epidemiol 1996;17:114-18.

30. Jarvis WR. *The epidemiology of colonization.* Infect Control Hosp Epidemiol 1996;17:47-52.

31. Goldmann DA, Weinstein RA, Wenzel RP et al. *Strategies to prevent and control the emergence and spread of antimicrobial-resistant microorganisms in hospitals.* JAMA 1996;275:234-40.

32. Goldmann DA, Huskins WC. *Control of nosocomial antimicrobial resistant bacteria: a strategic priority for hospitals worldwide.* Clin Infect Dis 1997;24(Suppl. 1):S139-45.

33. HICPAC. *Recommendations for preventing the spread of vancomycin resistance: recommendations of the Hospital Infection Control Practices Advisory Committee (HICPAC).* Am J Infect Control 1995;23:87-94.

34. Shlaes DM, Gerding DN, John JF et al. *Society for Healthcare Epidemiology of America and Infectious Diseases Society of America Joint Committee on the Prevention of Antimicrobial Resistance: Guidelines for the prevention of antimicrobial resistance in hospitals.* Clin Infect Dis 1997;25:584-99.

35. Quale J, Landman D, Atwood E et al. *Experience with a hospital-wide outbreak of vancomycin-resistant enterococci.* Am J Infect Control 1996;24:372-79.

36. Morris JG, Shay DK, Hebden JN et al. *Enterococci resistant to multiple antimicrobial agents, including vancomycin: establishment of endemicity in a university medical centre.* Ann Intern Med 1995;123:250-59.

37. Wells CL, Juni BA, Cameron SB et al. *Stool carriage, clinical isolation, and mortality during an outbreak of vancomycin-resistant enterococci in hospitalized medical and/or surgical patients.* Clin Infect Dis 1995;21:45-50.

38. Frank AL, Taber LH, Wells CR et al. *Patterns of shedding of myxoviruses and paramyxoviruses in children.* J Infect Dis 1981;144:433-41.

39. Goldwater PN, Martin AJ, Ryan B et al. *A survey of nosocomial respiratory viral infections in a children's hospital: occult respiratory infection in patients admitted during an epidemic season.* Infect Control Hosp Epidemiol 1991;12:231-38.

40. Pickering LK, Bartlett AV, Reves RR et al. *Asymptomatic excretion of rotavirus before and after rotavirus diarrhea in children in day care centres.* J Pediatr 1988;112:361-65.

41. Nicolle LE. *Nursing home dilemmas.* Infect Control Hosp Epidemiol 1997;18:806-08.

42. Mulligan ME, Murray-Leisure KA, Ribner BS et al. *Methicillin-resistant* ***Staphylococcus aureus****: a consensus review of the microbiology, pathogenesis, and epidemiology with implications for prevention and management.* Am J Med 1993;94:313-28.

43. McGowan JE, Tenover FC. *Control of antimicrobial resistance in the health care system.* Infect Dis Clin North Am 1997;11:297-311.

44. Birnbaum D, Schulzer M, Mathias RG et al. *Adoption of guidelines for universal precautions and body substance isolation in Canadian acute-care hospitals.* Infect Control Hosp Epidemiol 1990;11:465-72.

45. American Academy of Pediatrics. *Infection control for hospitalized children.* In: Peter G, ed. *1997 Red Book: report of the Committee on Infectious Diseases.* Twenty-Fourth ed. Elk Grove Village, Illinois: American Academy of Pediatrics, 1997:100-07.

46. American Academy of Pediatrics Committee on Infectious Diseases. *The revised CDC guidelines for isolation precautions in hospitals: implications for pediatrics.* Pediatrics 1998;101:466 (e13).

47. Stover BH. *The 1996 CDC and HICPAC isolation guideline: a pediatric perspective.* Am J Infect Control 1996;24:201-02.

48. Brachman PS. *Epidemiology of nosocomial infections.* In: Bennett JV, Brachman PS, eds. *Hospital infections.* 4th ed. Philadelphia: Lippincott-Raven Publishers, 1998:3-16.

49. Nelson JD. *Jails, microbes and the three-foot barrier.* N Engl J Med 1996;335:885-86.

50. Feigin RD, Baker C, Herwaldt LA et al. *Epidemic meningococcal disease in an elementary-school classroom.* N Engl J Med 1982;307:1255-57.

51. Bean B, Moore BM, Sterner B et al. *Survival of influenza viruses on environmental surfaces.* J Infect Dis 1982;146:47-51.

52. Brady MT, Evans J, Cuartas J. *Survival and disinfection of parainfluenza viruses on environmental surfaces.* Am J Infect Control 1990;18:18-23.

53. Hall CB, Douglas RG, Geiman JM. *Possible transmission by fomites of respiratory syncytial virus.* J Infect Dis 1980;141:98-102.

54. Hendley JO, Wenzel RP, Gwaltney JM. *Transmission of rhinovirus colds by self-inoculation.* N Engl J Med 1973;288:1361-64.

55. Hall CB, Douglas RG. *Modes of transmission of respiratory syncytial virus.* J Pediatr 1981;99:100-03.

56. Hall CB, Douglas RG, Schnabel KC et al. *Infectivity of respiratory syncytial virus by various routes of inoculation.* Infect Immun 1981;33:779-83.

57. Larsen RA, Jacobson JT, Jacobson JA et al. *Hospital-associated outbreak of pharyngitis and conjunctivitis caused by adenovirus.* J Infect Dis 1986;154:706-09.

58. Gwaltney JM, Moskalski PB, Hendley JO. *Hand-to-hand transmission of rhinovirus colds.* Ann Intern Med 1978;88:463-67.

59. Dick EC, Jennings LC, Mink KA et al. *Aerosol transmission of rhinovirus colds.* J Infect Dis 1987;156:442-48.

60. Graman PS, Hall CB. *Epidemiology and control of nosocomial viral infections.* Infect Dis Clin North Am 1989;3:815-41.

61. Whimbey E, Bodey GP. *Viral pneumonia in the immunocompromised adult with neoplastic disease: the role of common community respiratory viruses.* Semin Respir Infect 1992;7:122-31.

62. Yousuf HM, Englund J, Couch R et al. *Influenza among hospitalized adults with leukemia.* Clin Infect Dis 1997;24:1095-99.

63. Lewis VA, Champlin R, Englund J et al. *Respiratory disease due to parainfluenza virus in adult bone marrow transplant recipients.* Clin Infect Dis 1996;23:1033-37.

64. Falsey AR. *Noninfluenza respiratory virus infection in long-term care facilities.* Infect Control Hosp Epidemiol 1991;12:602-08.

65. Falsey AR, Treanor JJ, Betts RF et al. *Viral respiratory infections in the institutionalized elderly: clinical and epidemiologic findings.* J Am Geriatr Soc 1992;40:115-19.

66. Guidry GG, Black-Payne CA, Payne DK et al. *Respiratory syncytial virus infection among intubated adults in a university medical intensive care unit.* Chest 1991;100:1377-84.

67. Couch RB, Cate TR, Douglas RG et al. *Effect of route of inoculation on experimental respiratory viral disease in volunteers and evidence for airborne transmission.* Bact Rev 1966;30:517-29.

68. CDC. *Guidelines for preventing the transmission of* ***Mycobacterium tuberculosis*** *in health-care facilities, 1994.* MMWR 1994;43 (RR - 13):1-132.

69. Riley RL. *Aerial dissemination of pulmonary tuberculosis.* Am Rev Tuberc Pulmon Dis 1957;76:931-41.

70. Houk VN, Baker JH, Sorensen K et al. *The epidemiology of tuberculosis infection in a closed environment.* Arch Environ Health 1968;16:26-34.

71. Kenyon TA, Valway SE, Ihle WW et al. *Transmission of multidrug-resistant* ***Mycobacterium tuberculosis*** *during a long airplane flight.* N Engl J Med 1996;334:933-38.

72. Wenzel RP. *Airline travel and infection.* N Engl J Med 1996;334:981-82.

73. Gustafson TL, Lavely GB, Brawner ER et al. *An outbreak of airborne nosocomial varicella.* Pediatrics 1982;70:550-56.

74. Leclair JM, Zaia JA, Levin MJ et al. *Airborne transmission of chickenpox in a hospital.* N Engl J Med 1980;302:450-53.

75. Sawyer MH, Chamberlin CJ, Wu YN et al. *Detection of varicella-zoster virus DNA in air sample from hospital rooms.* J Infect Dis 1994;169:91-94.

76. Josephson A, Gomert ME. *Airborne transmission of nosocomial varicella from localized zoster.* J Infect Dis 1988;158:238-41.

77. Riegle L, Cooperstock M. *Contagiousness of zoster in a day care setting.* Pediatr Infect Dis 1985;4:413.

78. Bloch AB, Orenstein WA, Ewing WM et al. *Measles outbreak in a pediatric practice: airborne transmission in an office setting.* Pediatrics 1985;75:676-83.

79. Ehresmann KR, Hedberg CW, Grimm MB et al. *An outbreak of measles at an international sporting event with airborne transmission in a domed stadium.* J Infect Dis 1995;171:679-83.

80. Remington PL, Hall WN, Davis IH et al. *Airborne transmission of measles in a physician's office.* JAMA 1985;253:1574-77.

81. Sheline JL, Lucer RL, Esquibel DS et al. *Measles transmission in a medical office building — New Mexico, 1986.* MMWR 1987;36:25-7.

82. Langmuir AD. *Changing concepts of airborne infection of acute contagious disease: a reconsideration of classic epidemiologic theories.* Ann N Y Acad Sci 1980;353:35-44.

83. CDC. *Guidelines for prevention of nosocomial pneumonia.* MMWR 1997;46:1-79.

84. Moser MR, Bender TR, Margolis HS et al. *An outbreak of influenza aboard a commercial airliner.* Am J Epidemiol 1979;110:1-6.

85. Loosli CG, Lemon HM, Robertson OH et al. *Experimental air-borne influenza infection. I. Influence of humidity on survival of virus in air.* Proc Soc Exp Biol Med 1943;53:205-06.

86. Morens DM, Rash VM. *Lessons from a nursing home outbreak of influenza A.* Infect Control Hosp Epidemiol 1995;16:275-80.

87. Keane E, Gilles HM. *Lassa fever in Panguma hospital, Sierra Leone, 1973-6.* BMJ 1977;1:1399-402.

88. CDC. *Update: management of patients with suspected viral hemorrhagic fever — United States.* MMWR 1995;44:475-79.

89. Peters CJ, Jahrling PB, Khan AS. *Patients infected with high-hazard viruses: scientific basis for infection control.* Arch Virol Suppl 1996;11:141-68.

90. Carey DE, Kemp GE, White HA et al. *Lassa fever. Epidemiological aspects of the 1970 epidemic, Jos, Nigeria.* Trans R Soc Trop Med Hyg 1972;66:402-08.

91. CDC, HICPAC. *Interim guidelines for prevention and control of staphylococcal infection associated with reduced susceptibility to vancomycin.* MMWR 1997;46:626-28.

92. CDC. ***Staphylococcus aureus** with reduced susceptibility to vancomycin — United States 1997.* MMWR 1997;46:765-66.

93. CDC. *Reduced susceptibility of **Staphylococcus aureus** to vancomycin — Japan 1996.* MMWR 1997;46:624-26.

94. Health Canada. *Controlling antimicrobial resistance: an integrated action plan for Canadians.* CCDR 1997;23S7:1-32.

95. Ayliffe GAJ, Buckles A, Casewell MW et al. *Revised guidelines for the control of methicillin-resistant **Staphylococcus aureus** infection in hospitals.* J Hosp Infect 1998;39:253-90.

96. Flaherty JP, Weinstein RA. *Nosocomial infection caused by antibiotic-resistant organisms in the intensive-care unit.* Infect Control Hosp Epidemiol 1996;17:236-48.

97. Bodnar UR, Noskin GA, Suriano T et al. *Use of in-house studies of molecular epidemiology and full species identification for controlling spread of vancomycin-resistant **Enterococcus faecalis** isolates.* J Clin Microbiol 1996;34:2129-32.

98. Weinstein RA, Hayden MK. *Multiply drug-resistant pathogens: epidemiology and control.* In: Bennett JV, Brachman PS, eds. *Hospital infections.* 4th ed. Philadelphia: Lippincott-Raven Publishers, 1998:215-36.

99. Bitar CM, Mayhall CG, Lamb VA et al. *Outbreak due to methicillin- and rifampin-resistant **Staphylococcus aureus**: epidemiology and eradication of the epidemic strain from the hospital.* Infect Control Hosp Epidemiol 1987;8:15-23.

100. Boyce JM. *Methicillin-resistant **Staphylococcus aureus** in hospitals and long-term care facilities: microbiology, epidemiology, and preventive measures.* Infect Control Hosp Epidemiol 1992;13:725-37.

101. Simor A, Ofner-Agostini M, Paton S. *The Canadian Nosocomial Infection Surveillance Program: results of the first 18 months of surveillance for methicillin-resistant **Staphylococcus aureus** in Canadian hospitals.* CCDR 1997;23-6:41-48.

102. Boyce JM, Opal SM, Chow JW et al. *Outbreak of multidrug-resistant **Enterococcus faecium** with transferable vanB class vancomycin resistance.* J Clin Microbiol 1994;32:1148-53.

103. Leclercq R, Courvalin P. *Resistance to glycopeptides in enterococci.* Clin Infect Dis 1997;24:545-56.

104. Nourse C, Murphy H, Byrne C et al. *Control of a nosocomial outbreak of vancomycin resistant **Enterococcus faecium** in a paediatric oncology unit: risk factors for colonisation.* Eur J Pediatr 1998;157:20-7.

105. Beezhold DW, Slaughter S, Hayden MK et al. *Skin colonization with vancomycin-resistant enterococci among hospitalized patients with bacteremia.* Clin Infect Dis 1997;24:704-06.

106. Yamaguchi E, Valena F, Smith SM et al. *Colonization pattern of vancomycin-resistant **Enterococcus faecium**.* Am J Infect Control 1994;22:202-06.

107. Didier ME, Havighurst T, Maki DG. *Epidemiology of nosocomial infection caused by multi-resistant ESBL-producing **Klebsiella*** (Abstract 50). Program and abstracts of the IDSA 34th Annual Meeting 1996:44.

108. Soulier A, Barbut F, Ollivier JM et al. *Decreased transmission of **Enterobacteriaceae** with extended-spectrum beta-lactamases in an intensive care unit by nursing reorganization.* J Hosp Infect 1995;31:89-97.

109. Chow JW, Fine MJ, Shlaes DM et al. ***Enterobacter** bacteremia: clinical features and emergence of antibiotic resistance during therapy.* Ann Intern Med 1991;115:585-90.

110. Modi N, Damjanovic V, Cooke RWI. *Outbreak of cephalosporin resistant **Enterobacter cloacae** infection in a neonatal intensive care unit.* Arch Dis Child 1987;62:148-51.

111. Meyer KS, Urban C, Eagan JA et al. *Nosocomial outbreak of **Klebsiella** infection resistant to late-generation cephalosporins.* Ann Intern Med 1993;119:353-58.

112. Thompson RL, Cabezudo I, Wenzel RP. *Epidemiology of nosocomial infections caused by methicillin-resistant **Staphylococcus aureus**.* Ann Intern Med 1982;97:309-17.

113. Boyce JM, Mermel LA, Zervos MJ et al. *Controlling vancomycin-resistant enterococci.* Infect Control Hosp Epidemiol 1995;16:634-37.

114. Weber DJ, Rutala WA. *Role of environmental contamination in the transmission of vancomycin-resistant enterococci.* Infect Control Hosp Epidemiol 1997;18:306-09.

115. Bonten MJM, Hayden MK, Nathan C et al. *Epidemiology of colonisation of patients and environment with vancomycin-resistant enterococci.* Lancet 1996;348:1615-19.

116. Lior L, Litt M, Hockin J, et al. *Vancomycin-resistant enterococci on a renal ward in an Ontario hospital.* CCDR 1996;22:125-28.

117. Boyce JM, Potter-Bynoe G, Chenevert C et al. *Environmental contamination due to methicillin-resistant **Staphylococcus aureus**: possible infection control implications.* Infect Control Hosp Epidemiol 1997;18:622-27.

118. Bradley SF, Terpenning MS, Ramsey MA et al. *Methicillin-resistant **Staphylococcus aureus**: colonization and infection in a long-term care facility.* Ann Intern Med 1991;115:417-21.

119. Rammelkamp CH, Mortimer EA, Wolinsky E. *Transmission of streptococcal and staphylococcal infections.* Ann Intern Med 1964;60:753-58.

120. Livornese LL, Dias S, Samel C et al. *Hospital-acquired infection with vancomycin-resistant **Enterococcus faecium** transmitted by electronic thermometers.* Ann Intern Med 1992;117:112-16.

121. Porwancher R, Sheth A, Remphrey S et al. *Epidemiological study of hospital-acquired infection with vancomycin-resistant **Enterococcus faecium**: possible transmission by an electronic ear-probe thermometer.* Infect Control Hosp Epidemiol 1997;18:771-73.

122. Gould FK, Freeman R. *Nosocomial infection with microsphere beds.* Lancet 1993;342:241-42.

123. Walder M, Haeggman S, Tullus K et al. *A hospital outbreak of high-level beta-lactam-resistant **Enterobacter spp**: association more with ampicillin and cephalosporin therapy than with nosocomial transmission.* Scand J Inf Dis 1996;28:293-96.

124. Hoefnagels-Schuermans A, Borremans A, Peetermans W et al. *Origin and transmission of methicillin-resistant **Staphylococcus aureus** in an endemic situation: differences between geriatric and intensive-care patients.* J Hosp Infect 1997;36:209-22.

125. Lugeon C, Blanc DS, Wenger A et al. *Molecular epidemiology of methicillin-resistant **Staphylococcus aureus** at a low-incidence hospital over a 4-year period.* Infect Control Hosp Epidemiol 1995;16:260-67.

126. Herold BC, Immergluck LC, Maranan MC et al. *Community-acquired methicillin-resistant **Staphylococcus aureus** in children with no identified predisposing risk.* JAMA 1998;279:593-98.

127. Jernigan JA, Clemence MA, Stott GA et al. *Control of methicillin-resistant **Staphylococcus aureus** at a university hospital: one decade later.* Infect Control Hosp Epidemiol 1995;16:686-96.

128. Embil J, Ramotar K, Romance L et al. *Methicillin-resistant **Staphylococcus aureus** in tertiary care institutions on the Canadian prairies 1990-1992.* Infect Control Hosp Epidemiol 1994;15:646-51.

129. Hartstein AI, Lemonte AM, Iwamoto PKL. *DNA typing and control of methicillin-resistant **Staphylococcus aureus** at two affiliated hospitals.* Infect Control Hosp Epidemiol 1997;18:42-48.

130. Troillet N, Carmeli Y, Samore MH et al. *Carriage of methicillin-resistant **Staphylococcus aureus** at hospital admission.* Infect Control Hosp Epidemiol 1998;19:181-85.

131. Maki DG, Zilz MA, McCormick R. *The effectiveness of using preemptive barrier precautions routinely (protective isolation) in all high-risk patients to prevent nosocomial infection with resistant organisms, especially MRSA, VRE and **C. difficile*** (abstract 43). Program and abstracts of the IDSA 34th Annual Meeting 1996:43.

132. Boyce JM. *Should we vigorously try to contain and control methicillin-resistant **Staphylococcus aureus**?* Infect Control Hosp Epidemiol 1991;12:46-54.

133. Handwerger S, Raucher B, Altarac D et al. *Nosocomial outbreak due to **Enterococcus faecium** highly resistant to vancomycin, penicillin, and gentamicin.* Clin Infect Dis 1993;16:750-55.

134. Jernigan JA, Titus MG, Groschel DH et al. *Effectiveness of contact isolation during a hospital outbreak of methicillin-resistant **Staphylococcus aureus**.* Am J Epidemiol 1996;143:496-504.

135. Murray-Leisure KA, Geib S, Graceley D. *Control of epidemic methicillin-resistant **Staphylococcus aureus**.* Infect Control Hosp Epidemiol 1990;11:343-50.

136. Hartstein AI, Denny MA, Morthland VH et al. *Control of methicillin-resistant **Staphylococcus aureus** in a hospital and an intensive care unit.* Infect Control Hosp Epidemiol 1995;16:405-11.

137. Slaughter S, Hayden MK, Nathan C et al. *A comparison of the effect of universal use of gloves and gowns with that of glove use alone on acquisition of vancomycin-resistant enterococci in a medical intensive care unit.* Ann Intern Med 1996;125:448-56.

138. Fazal B, Telzak E, Blum S et al. *Trends in the prevalence of methicillin-resistant **Staphylococcus aureus** associated with discontinuation of an isolation policy.* Infect Control Hosp Epidemiol 1996;17:372-74.

139. Sheridan RL, Weber J, Benjamin J et al. *Control of methicillin-resistant **Staphylococcus aureus** in a pediatric burn unit.* Am J Infect Control 1994;22:340-45.

140. Haley RW, Cushion NB, Tenover FC et al. *Eradication of endemic methicillin-resistant **Staphylococcus aureus** infections from a neonatal intensive care unit.* J Infect Dis 1995;171:614-24.

141. Boyce JM, Jackson MM, Pugliese G et al. *Methicillin-resistant **Staphylococcus aureus** (MRSA): a briefing for acute care hospitals and nursing facilities.* Infect Control Hosp Epidemiol 1994;15:105-15.

142. Frank MO, Batteiger BE, Sorensen SJ et al. *Decrease in expenditures and selected nosocomial infections following implementation of an antimicrobial-prescribing improvement program.* Clin Perf Qual Health Care 1997;5:180-88.

143. Quale J, Landman D, Saurina G et al. *Manipulation of a hospital antimicrobial formulary to control an outbreak of vancomycin-resistant enterococci.* Clin Infect Dis 1996;23:1020-25.

144. Bonilla HF, Zervos MA, Lyons MJ et al. *Colonization with vancomycin-resistant **Enterococcus faecium**: comparison of a long-term-care unit with an acute-care hospital.* Infect Control Hosp Epidemiol 1997;18:333-39.

145. Chenoweth CE, Bradley SF, Terpenning MS et al. *Colonization and transmission of high-level gentamicin-resistant enterococci in a long-term care facility.* Infect Control Hosp Epidemiol 1994;15:703-09.

146. Crossley K. The Long-Term-Care Committee of the Society for Healthcare Epidemiology of America. *Vancomycin-resistant enterococci in long-term-care facilities.* Infect Control Hosp Epidemiol 1998;19:521-25.

147. Strausbaugh LJ, Crossley KB, Nurse BA et al. *Antimicrobial resistance in long-term-care facilities.* Infect Control Hosp Epidemiol 1996;17:129-40.

148. Hsu CC. *Serial survey of methicillin-resistant **Staphylococcus aureus** nasal carriage among residents in a nursing home.* Infect Control Hosp Epidemiol 1991;12:416-21.

149. Murphy S, Denman S, Bennet RG et al. *Methicillin-resistant **Staphylococcus aureus** colonization in a long-term-care facility.* J Am Geriatr Soc 1992;40:213-17.

150. Terpenning MS, Bradley SF, Wan JY et al. *Colonization and infection with antibiotic-resistant bacteria in a long-term care facility.* J Am Geriatr Soc 1994;42:1062-69.

151. Muder RR, Brennen C, Drenning SD et al. *Multiply antibiotic-resistant gram-negative bacilli in a long-term-care facility: a case-control study of patient risk factors and prior antibiotic use.* Infect Control Hosp Epidemiol 1997;18:809-13.

152. Strausbaugh LJ, Jacobson C, Sewell DL et al. *Methicillin-resistant **Staphylococcus aureus** in extended-care facilities: experiences in a Veterans Affairs nursing home and a review of the literature.* Infect Control Hosp Epidemiol 1991;12:36-45.

153. Lee YL, Cesario T, Gupta G et al. *Surveillance of colonization and infection with **Staphylococcus aureus** susceptible or resistant to methicillin in a community skilled-nursing facility.* Am J Infect Control 1997;25:312-21.

154. CDC. *Outbreaks of pneumococcal pneumonia among unvaccinated residents in chronic-care facilities — Massachusetts, October 1995, Oklahoma, February 1996, and Maryland, May-June 1996.* MMWR 1997;46:60-62.

155. Nuorti JP, Butler JC, Crutcher JM et al. *An outbreak of multi-drug resistant pneumococcal pneumonia and bacteremia among unvaccinated nursing home residents.* N Engl J Med 1998;338:1861-68.

156. Mannheimer SB, Riley LW, Roberts RB. *Association of penicillin-resistant pneumococci with residence in a pediatric chronic care facility.* J Infect Dis 1996;174:513-19.

157. Bradley SF. *Methicillin-resistant **Staphylococcus aureus** infection.* Clin Ger Med 1992;8:853-68.

158. Cahill CK, Rosenberg J. *Guideline for prevention and control of antibiotic-resistant microorganisms in California long-term care facilities.* J Gerontol Nurs 1996;22(May):40-7.

159. Larson E, Bobo L, Bennett R et al. *Lack of care giver hand contamination with endemic bacterial pathogens in a nursing home.* Am J Infect Control 1991;19:11-15.

160. Strausbaugh LJ, Jacobson C, Sewell DL et al. *Antimicrobial therapy for methicillin-resistant* ***Staphylococcus aureus*** *colonization in residents and staff of a Veterans Affairs nursing home care unit.* Infect Control Hosp Epidemiol 1992;13:151-59.

161. Lai KK, Fontecchio SA, Kelley AL et al. *The epidemiology of fecal carriage of vancomycin-resistant enterococci.* Infect Control Hosp Epidemiol 1997;18:762-65.

162. Montecalvo MA, de Lencastre H, Carraher M et al. *Natural history of colonization with vancomycin-resistant* ***Enterococcus faecium***. Infect Control Hosp Epidemiol 1995;16:680-85.

163. Dedier H, Hanak C, Garcia M et al. *Prolonged gastrointestinal tract colonization with vancomycin-resistant* ***Enterococcus faecium*** *in a dialysis population* (abstract O44). Can J Inf Dis 1997;8:361.

164. Garcia M, Hanak C, Dedier H et al. *A prospective evaluation of the reintegration of hospitalized patients colonized with vancomycin-resistant enterococci (VRE) based on a likelihood of transmission (LOT) assessment* (abstract 016). Can J Inf Dis 1997;8:361.

165. Rosenberg J. *Methicillin-resistant* ***Staphylococcus aureus*** *(MRSA) in the community: who's watching?* Lancet 1995;346:132-33.

166. Smith TL, Iwen PC, Olson SB et al. *Environmental contamination with vancomycin-resistant enterococci in an outpatient setting.* Infect Control Hosp Epidemiol 1998;19:515-20.

167. Centers for Disease Control. *Nosocomial transmission of multidrug-resistant tuberculosis to health-care workers and HIV-infected patients in an urban hospital — Florida.* MMWR 1990;39:718-22.

168. Fung SC, Dick H, Devlin H et al. *Transmissibility and infection control implications of* ***Burkholderia cepacia*** *in cystic fibrosis.* Can J Inf Dis 1998;9:177-82.

169. Emond MB, Ober JF, Weinbaum DL et al. *Vancomycin-resistant* ***Enterococcus faecium*** *bacteremia: risk factors for infection.* Clin Infect Dis 1995;20:1126-33.

170. Yu VL, Goetz A, Wagener M et al. ***Staphylococcus aureus*** *nasal carriage and infection in patients on hemodialysis.* N Engl J Med 1986;315:91-96.

171. Ward RL, Bernstein DI, Knowlton DR et al. *Prevention of surface-to-human transmission of rotaviruses by treatment with disinfectant spray.* J Clin Microbiol 1991;29:1991-96.

172. Sattar SA, Lloyd-Evans N, Springthorpe VS et al. *Institutional outbreaks of rotavirus diarrhea: potential role of fomites and environmental surfaces as vehicles for virus spread.* J Hyg 1986;96:277-89.

173. Keswick BH, Pickering LK, DuPont HL et al. *Survival and detection of rotaviruses on environmental surfaces in day care centres.* Appl Environ Microbiol 1983;46:813-16.

174. Gerding D, Johnson S, Peterson L et al. ***Clostridium difficile**-associated diarrhea and colitis.* Infect Control Hosp Epidemiol 1995;16:459-77.

175. Johnson S, Gerding DN. ***Clostridium difficile**-associated diarrhea.* Clin Infect Dis 1998;26:1027-36.

176. Brooks S, Khan A, Stoica D et al. *Reduction in vancomycin-resistant **Enterococcus** and **Clostridium difficile** infections following change to tympanic thermometers.* Infect Control Hosp Epidemiol 1998;19:333-36.

177. Jernigan JA, Siegman-Igra Y, Guerrant RC et al. *A randomized crossover study of disposable thermometers for prevention of **Clostridium difficile** and other nosocomial infections.* Infect Control Hosp Epidemiol 1998;19:494-99.

178. Manian FA, Meyer L, Jenne J. ***Clostridium difficile** contamination of blood pressure cuffs: a call for a closer look at gloving practices in the era of universal precautions.* Infect Control Hosp Epidemiol 1996;17:180-82.

179. Myers MG. *Longitudinal evaluation of neonatal nosocomial infections: association of infection with a blood pressure cuff.* Pediatrics 1978;61:42-45.

180. Smith MA, Mathewson JJ, Ulert A et al. *Contaminated stethoscopes revisited.* Arch Intern Med 1996;156:82-84.

181. Cohen HA, Amir J, Matalon A et al. *Stethoscopes and otoscopes — a potential vector of infection?* Fam Pract 1997;14:446-49.

182. Dias CAG, Kader IA, d'Azevedo P et al. *Detection of methicillin-resistant **Staphylococcus aureus** (MRSA) in stethoscopes.* Revista de Microbiologia 1997;28:82-4.

183. Wright IM, Orr H, Porter C. *Stethoscope contamination in the neonatal intensive care unit.* J Hosp Infect 1995;29:65-8.

184. Jones JS, Hoerle D, Riekse R. *Stethoscopes: a potential vector of infection?* Ann Emerg Med 1995;26:296-99.

185. Marinella MA, Pierson C, Chenoweth C. *The stethoscope: a potential source of nosocomial infection?* Arch Intern Med 1997;157:786-90.

186. Jackson MM, Lynch P. *Guideline for isolation precautions in hospitals.* Am J Infect Control 1996;24:203-06.

187. Rutala WA, Stiegel MM, Sarubbi FA et al. *Susceptibility of antibiotic-susceptible and antibiotic-resistant hospital bacteria to disinfectants.* Infect Control Hosp Epidemiol 1997;18:417-21.

188. Byers KE, Durbin LJ, Simonton BM et al. *Disinfection of hospital rooms contaminated with vancomycin-resistant **Enterococcus faecium**.* Infect Control Hosp Epidemiol 1998;19:261-64.

189. Fryklund B, Haeggman S, Burman LG. *Transmission of urinary bacterial strains between patients with indwelling catheters — nursing in the same room and in separate rooms compared.* J Hosp Infect 1997;36:147-53.

190. Dajani AS, Taubert KA, Wilson W et al. *Prevention of bacterial endocarditis. Recommendations by the American Heart Association.* JAMA 1997;277:1794-801.

191. CDC. *Update: provisional public health service recommendations for chemoprophylaxis after occupational exposure to HIV.* MMWR. 1996;45:468-73.

192. Health Canada. *An integrated protocol to manage health care workers exposed to bloodborne pathogens.* CCDR 1997;23S2:1-14.

193. O'Boyle Williams C, Feldt K. *A nursing challenge: methicillin-resistant* ***Staphylococcus aureus*** *in long-term care.* J Gerontol Nurs 1993;July:22-28.

194. Edmond MB, Wenzel RP, Pasculle AW. *Vancomycin-resistant* ***Staphylococcus aureus****: perspectives on measures needed for control.* Ann Intern Med 1996;124:329-34.

195. Strausbaugh LJ, Joseph C. *Epidemiology and prevention of infections in residents of long-term care facilities.* In: Mayhall CG, ed. *Hospital epidemiology and infection control.* Baltimore, MD: Williams & Wilkins, 1996:1151-70.

196. Nicolle LE, Garibaldi RA. *Infection control in long-term-care facilities.* Infect Control Hosp Epidemiol 1995;16:348-53.

197. Ellis E. *Influenza outbreaks in long-term care facilities, 1988-1989 season.* CDWR 1989;15:239-41.

198. Christie RB, Marquis LL. *Immunization roulette: influenza occurrence in five nursing homes.* Am J Infect Control 1985;13:174-77.

199. Addiss DG, Davis JP, Meade BD et al. *A pertussis outbreak in a Wisconsin nursing home.* J Infect Dis 1991;164:704-10.

200. Hall WN, Goodman RA, Noble GR et al. *An outbreak of influenza B in an elderly population.* J Infect Dis 1981;144:297-302.

201. Fisher MC, Long SS, McGowan KL et al. *Outbreak of pertussis in a residential facility for handicapped people.* J Pediatr 1989;114:934-39.

202. Troy CJ, Peeling RW, Ellis AG et al. ***Chlamydia pneumoniae*** *as a new source of infectious outbreaks in nursing homes.* JAMA 1997;277:1214-18.

203. Ryan MJ, Wall PG, Adak GK et al. *Outbreaks of infectious intestinal disease in residential institutions in England and Wales 1992-1994.* J Infect 1997;34:49-54.

204. Gellert GA, Waterman SH, Ewert D et al. *An outbreak of acute gastroenteritis caused by a small round structured virus in a geriatric convalescent facility.* Infect Control Hosp Epidemiol 1990;11:459-64.

205. Carter AO, Borczyk AA, Carlson JAK et al. *A severe outbreak of* ***Escherichia Coli*** *O157:H7 associated hemorrhagic colitis in a nursing home.* N Engl J Med 1987;317:1496-500.

206. Pegues DA, Woernle CH. *An outbreak of acute nonbacterial gastroenteritis in a nursing home.* Infect Control Hosp Epidemiol 1993;14:87-94.

207. Levine WC, Smart JF, Archer DL et al. *Foodborne disease outbreaks in nursing homes, 1975 through 1987.* JAMA 1991;266:2105-09.

208. Bentley DW. ***Clostridium difficile**-associated disease in long-term care facilities.* Infect Control Hosp Epidemiol 1990;11:434-38.

209. Stead WW. *Tuberculosis among elderly persons: an outbreak in a nursing home.* Ann Intern Med 1981;94:606-10.

210. Bentley DW. *Tuberculosis in long-term care facilities.* Infect Control Hosp Epidemiol 1990;11:42-46.

211. CDC. *Prevention and control of tuberculosis in facilities providing long-term care to the elderly: recommendations of the Advisory Committee for the Elimination of Tuberculosis.* MMWR 1990;39 (RR-10):7-20.

212. Schwartz B, Ussery XT. *Group A Streptococcal outbreaks in nursing homes.* Infect Control Hosp Epidemiol 1992;13:742-47.

213. Degelau J. *Scabies in long-term care facilities.* Infect Control Hosp Epidemiol 1992;13:421-25.

214. De La Rue Browne S. *Scabies investigation at a local nursing home.* Can J Public Health 1988;79:134-35.

215. Goodman RA, Solomon SL. *Transmission of infectious diseases in outpatient health care settings.* JAMA 1991;265:2377-81.

216. Herwaldt LA, Smith SD, Carter CD. *Infection control in the outpatient setting.* Infect Control Hosp Epidemiol 1998;19:41-74.

217. Nafziger DA, Lundstrom T, Chandra S et al. *Infection control in ambulatory care.* Infect Dis Clin North Am 1997;11:279-96.

218. Jackson MM, Lynch P. *Ambulatory care settings.* In: Bennett JV, Brachman PS, eds. *Hospital infections.* 4th ed. Philadelphia, PA: Lippincott-Raven, 1998:431-44.

219. Gindler JS, Atkinson WL, Markowitz LE et al. *Epidemiology of measles in the United States in 1989 and 1990.* Pediatr Infect Dis J 1992;11:841-46.

220. CDC. ***Mycobacterium tuberculosis** transmission in a health clinic — Florida, 1988.* MMWR 1989;38:256-64.

221. Couldwell DL, Dore GJ, Harkness JL et al. *Nosocomial outbreak of tuberculosis in an outpatient HIV treatment room.* AIDS 1996;10:521-25.

222. Lobovits AM, Freeman J, Goldmann DA et al. *Risk of illness after exposure to a pediatric office.* N Engl J Med 1985;313:425-28.

223. Smith PW, Roccaforte JS. *Epidemiology and prevention of infections in home health care.* In: Mayhall CG, ed. *Hospital epidemiology and infection control.* Baltimore, MD: Williams & Wilkins, 1996:1171-75.

224. Simmons B, Trusler M, Roccaforte J et al. *Infection control for home health.* Infect Control Hosp Epidemiol 1990;11:362-70.

225. White MC. *Infections and infection risk in home care settings.* Infect Control Hosp Epidemiol 1992;13:535-39.

226. White MC, Smith W. *Infection control in home care agencies.* Am J Infect Control 1993;21:146-50.

227. Lorenzen AN, Itkin DJ. *Surveillance of infection in home care.* Am J Infect Control 1992;20:326-29.

228. Smith, PW. *Infection prevention in the home health setting.* Asepsis 1994;16:9-11.

229. Herwaldt LA. *Ethical aspects of infection control.* Infect Control Hosp Epidemiol 1996;17:108-13.

230. Jackson MM. *Isolation in the nursing home setting.* J Gerontol Nurs 1996;May 22:8-9.

231. Larson E. *A casual link between handwashing and risk of infection? Examination of the evidence.* Infect Control Hosp Epidemiol 1988;9:28-36.

232. Health Canada. *Infection control guidelines. Hand washing, cleaning, disinfection and sterilization in health care.* CCDR 1998;24S8:1-55.

233. Larson EL, APIC Guidelines Committee. *APIC Guideline for hand washing and hand antisepsis in health care settings.* Am J Infect Control 1995;23:251-69.

234. Steere AC, Mallison GF. *Handwashing practices for the prevention of nosocomial infections.* Ann Intern Med 1975;83:683-90.

235. Albert RK, Condie F. *Hand-washing patterns in medical intensive-care units.* N Engl J Med 1981;304:1465-66.

236. Graham M. *Frequency and duration of handwashing in an intensive care unit.* Am J Infect Control 1990;18:77-80.

237. Larson E, Bryan J, Adler L et al. *A multifaceted approach to changing handwashing behavior.* Am J Infect Control 1997;25:3-10.

238. Mayer JA, Dubbert PM, Miller M et al. *Increasing handwashing in an intensive care unit.* Infect Control 1986;7:259-62.

239. Preston GA, Larson EL, Stamm WE. *The effect of private isolation rooms on patient care practices, colonization and infection in an intensive care unit.* Am J Med 1981;70:641-45.

240. Simmons B, Bryant J, Neiman K et al. *The role of handwashing in prevention of endemic intensive care unit infections.* Infect Control Hosp Epidemiol 1990;11:589-94.

241. Pittet D, Mourouga P, Perneger TV et al. *Compliance with handwashing in a teaching hospital.* Ann Intern Med 1999;130:126-30.

242. Donowitz LG. *Handwashing technique in a pediatric intensive care unit.* Am J Dis Child 1987;141:683-85.

243. Brown J, Froesefretz A, Luckey D et al. *High rate of hand contamination and low rate of hand washing before infant contact in a neonatal intensive care unit.* Pediatr Infect Dis J 1996;15:908-10.

244. De Carvalho M, Lopes JMA, Pellitteri M. *Frequency and duration of handwashing in a neonatal intensive care unit.* Pediatr Infect Dis J 1989;8:179-80.

245. Larson E. *Compliance with isolation techniques.* Am J Infect Control 1983;11:221-25.

246. Lund S, Jackson J, Leggett J et al. *Reality of glove use and handwashing in a community hospital.* Am J Infect Control 1994;22:352-7.

247. Thompson BL, Dwyer DM, Ussery XT et al. *Handwashing and glove use in a long-term-care facility.* Infect Control Hosp Epidemiol 1997;18:97-103.

248. Conly JM, Hill S, Ross J et al. *Handwashing practices in an intensive care unit: The effects of an educational program and its relationship to infection rates.* Am J Infect Control 1989;17:330-39.

249. Doebbeling BN, Stanley GL, Sheetz CT et al. *Comparative efficacy of alternative hand-washing agents in reducing nosocomial infections in intensive care units.* N Engl J Med 1992;327:88-93.

250. Dubbert PM, Dolce J, Richter W et al. *Increasing ICU staff handwashing: effects of education and group feedback.* Infect Control Hosp Epidemiol 1990;11:191-94.

251. Larson E, McGeer A, Quaraishi A et al. *Effect of an automated sink on handwashing practices and attitudes in high-risk units.* Infect Control Hosp Epidemiol 1991;12:422-28.

252. Kaplan LM, McGuckin M. *Increasing handwashing compliance with more accessible sinks.* Infect Control 1986;7:408-10.

253. Larson E, Killien M. *Factors influencing handwashing behaviour of patient care personnel.* Am J Infect Control 1982;10:93-99.

254. McGuckin M, Bello S, Khan F et al. *Did you wash your hands? A handwashing education model for patients* (abstract M63). Infect Control Hosp Epidemiol 1997;18:P52.

255. McGuckin M, Caruso M, Krug E et al. *Handwashing compliance: the effect of a patient education program* (abstract M64). Infect Control Hosp Epidemiol 1997;18:P53.

256. Voss A, Widmer AF. *No time for handwashing!? Handwashing versus alcoholic rub: can we afford 100% compliance?* Infect Control Hosp Epidemiol 1997;18:205-08.

257. Ehrenkranz NJ. *Bland soap handwash or hand antisepsis? The pressing need for clarity.* Infect Control Hosp Epidemiol 1992;13:299-301.

258. Ehrenkranz NJ, Alfonso BC. *Failure of bland soap handwash to prevent hand transfer of patient bacteria to urethral catheters.* Infect Control Hosp Epidemiol 1991;12:654-62.

259. Kjølen H, Andersen BM. *Handwashing and disinfection of heavily contaminated hands — effective or ineffective?* J Hosp Infect 1992;21:61-71.

260. Wade JJ, Desai N, Casewell MW. *Hygienic hand disinfection for the removal of epidemic vancomycin-resistant **Enterococcus faecium** and gentamicin-resistant **Enterobacter cloacae**.* J Hosp Infect 1991;18:211-18.

261. Bettin K, Clabots C, Mathie P et al. *Effectiveness of liquid soap vs chlorhexidine gluconate for the removal of **Clostridium difficile** from bare hands and gloved hands.* Infect Control Hosp Epidemiol 1994;15:697-702.

262. MacFarland LV, Mulligan ME, Kwok RYY et al. *Nosocomial acquisition of **Clostridium difficile** infection.* N Engl J Med 1989;320:204-10.

263. Larson E, Leyden JJ, McGinley KJ et al. *Physiologic and microbiologic changes in skin related to frequent handwashing.* Infect Control 1986;7:59-63.

264. Bellamy K, Alcock R, Babb JR et al. *A test for the assessment of "hygienic" hand disinfection using rotavirus.* J Hosp Infect 1993;24:201-10.

265. Larson EL, Eke PI, Laughon BE. *Efficacy of alcohol-based hand rinses under frequent-use conditions.* Antimicrob Agents Chemother 1986;30:542-44.

266. Lauharanta J, Ojajarvi J, Sarna S et al. *Prevention of dryness and eczema of the hands of hospital staff by emulsion cleansing instead of washing with soap.* J Hosp Infect 1991;17:207-15.

267. Doebbeling BN, Pfaller MA, Houston AK et al. *Removal of nosocomial pathogens from the contaminated glove: implications for glove reuse and handwashing.* Ann Intern Med 1988;109:394-98.

268. Olsen RJ, Lynch P, Coyle MB et al. *Examination gloves as barriers to hand contamination in clinical practice.* JAMA 1993;270:350-53.

269. Rossoff LJ, Borenstein M, Isenburg HD. *Is hand washing really needed in an intensive care unit?* Crit Care Med 1995;23:1211-16.

270. Klein BS, Perloff WH, Maki DG. *Reduction of nosocomial infection during pediatric intensive care by protective isolation.* N Engl J Med 1989;320:1714-21.

271. Nauseef WM, Maki DG. *A study of the value of simple protective isolation in patients with granulocytopenia.* N Engl J Med 1981;304:448-53.

272. Malone N, Larson E. *Factors associated with a significant reduction in hospital-wide infection rates.* Am J Infect Control 1996;24:180-85.

273. Johnson S, Gerding DN, Olson MM et al. *Prospective, controlled study of vinyl glove use to interrupt **Clostridium difficile** nosocomial transmission.* Am J Med 1990;88:137-40.

274. Leclair JM, Freeman J, Sullivan BF et al. *Prevention of nosocomial respiratory syncytial virus infections through compliance with glove and gown isolation precautions.* N Engl J Med 1987;317:329-34.

275. Weinstein RA, Kabins SA. *Strategies for prevention and control of multiple drug-resistant nosocomial infection.* Am J Med 1981;70:449-54.

276. Maki DG, McCormick RD, Zilz MA. *An MRSA outbreak in an SICU during universal precautions: a new epidemiology for nosocomial MRSA: downside for universal precautions.* Proceedings of the Third Decennial International Conference on Nosocomial Infections, Atlanta, 1990.

277. Patterson JE, Vecchio J, Pantelick EL et al. *Association of contaminated gloves with transmission of* ***Acinetobacter calcoaceticus var. anitratus*** *in an intensive care unit.* Am J Med 1991;91:479-83.

278. Bubak ME, Reed CE, Fransway AF et al. *Allergic reactions to latex among health-care workers.* Mayo Clin Proc 1992;67:1075-79.

279. Kotilainen H, Brinker J, Avato J et al. *Latex and vinyl examination gloves: quality control. Procedures and implications for the health care workers.* Arch Intern Med 1989;149:2749-53.

280. Perceval A. *Wash hands, disinfect hands, or don't touch? Which, when, and why?* Infect Control Hosp Epidemiol 1993;14:273-75.

281. Cloney DL, Donowitz LG. *Overgown use for infection control in nurseries and neonatal intensive care units.* Am J Dis Child 1986;140:680-83.

282. Haque KN, Chagla AH. *Do gowns prevent infection in neonatal intensive care units?* J Hosp Infect 1989;14:159-62.

283. Pelke S, Ching D, Easa D et al. *Gowning does not affect colonization or infection rates in a neonatal intensive care unit.* Arch Pediatr Adolesc Med 1994;148:1016-20.

284. Donowitz LG. *Failure of the overgown to prevent nosocomial infection in a pediatric intensive care unit.* Pediatrics 1986;77:35-38.

285. Birenbaum H, Glorioso L, Rosenberger C et al. *Gowning on a postpartum ward fails to decrease colonization in the newborn infant.* Am J Dis Child 1990;144:1031-33.

286. Rush J, Fiorino-Chiovitti R, Kaufman K et al. *A randomized controlled trial of a nursery ritual: wearing cover gowns to care for healthy newborns.* Birth 1990;17:25-30.

287. Hall CB, Douglas RG. *Nosocomial respiratory syncytial viral infections. Should gowns and masks be used?* Am J Dis Child 1981;135:512-15.

288. Murphy D, Todd JK, Chao RK et al. *The use of gowns and masks to control respiratory illness in pediatric hospital personnel.* J Pediatr 1981;99:746-50.

289. Gala CL, Hall CB, Schnabel KC et al. *The use of eye-nose goggles to control nosocomial respiratory syncytial virus infection.* JAMA 1986;256:2706-08.

290. Agah R, Cherry JD, Garakian AJ et al. *Respiratory syncytial virus (RSV) infection rate in personnel caring for children with RSV infections. Routine isolation precautions vs. routine procedure supplemented by use of masks and goggles.* Am J Dis Child 1987;141:695-97.

291. Mulin B, Rouget C, Clément C et al. *Association of private isolation rooms with ventilator-associated* ***Acinetobacter baumanii*** *pneumonia in a surgical intensive-care unit.* Infect Control Hosp Epidemiol 1997;18:499-503.

292. Harrison A, Jewell S, Ponsonby J et al. *Infection control in pediatrics.* Germs and Ideas 1996;1:110-14.

293. Krasinski K, LaCouture R, Holzman RS et al. *Screening for respiratory syncytial virus and assignment to a cohort at admission to reduce nosocomial transmission.* J Pediatr 1990;116:894-98.

294. Snydman DR, Greer C, Meissner C et al. *Prevention of transmission of respiratory syncytial virus in a newborn nursery.* Infect Control Hosp Epidemiol 1988;9:105-08.

295. Madge P, Paton JY, McColl JH et al. *Prospective controlled study of four infection-control procedures to prevent nosocomial infection with respiratory syncytial virus.* Lancet 1992;340:1079-83.

296. Millar MR, Keyworth N, Lincoln C et al. *Methicillin-resistant* ***Staphylococcus aureus*** *in a regional neonatology unit.* J Hosp Infect 1987;10:187-97.

297. Beekman SE, Engler HD, Collins AS et al. *Rapid identification of respiratory viruses: impact on isolation practices and transmission among immunocompromised pediatric patients.* Infect Control Hosp Epidemiol 1996;17:581-86.

298. Ehrenkranz NJ, Sanders CC, Eckert-Schollenberger D et al. *Lack of evidence of efficacy of cohorting nursing personnel in a neonatal intensive care unit to prevent contact spread of bacteria: an experimental study.* Pediatr Infect Dis J 1992;11:105-13.

299. Kim MM, Mindorff C, Patrick ML et al. *Isolation usage in a pediatric hospital.* Infect Control 1987;8:195-99.

300. Langley JM, Hanakowski M, Bortolussi R. *Demand for isolation beds in a pediatric hospital.* Am J Infect Control 1994;22:207-11.

301. Holton D, Gibson H, Paton S et al. *Tuberculosis (TB) hospital readiness study in Canadian acute care facilities 1989-1993* (abstract 34). Infect Control Hosp Epidemiol 1996;17(Suppl. 2):21.

302. Huebner J, Pier GB, Maslow JN et al. *Endemic nosocomial transmission of* ***Staphylococcus epidermidis*** *bacteremia isolates in a neonatal intensive care unit over 10 years.* J Infect Dis 1994;169:526-31.

303. Vasquez JA, Sanchez V, Dmuchowski C et al. *Nosocomial acquisition of* ***Candida albicans****: an epidemiologic study.* J Infect Dis 1993;168:195-201.

304. Ricketts M, Deschamps L. *Reported seroconversions to human immunodeficiency virus among workers worldwide — a review.* Can J Infect Control 1992;7:85-90.

305. Mast ST, Woolvine JD, Gerberding JL. *Efficacy of gloves in reducing blood volumes transferred during simulated needlestick injury.* J Infect Dis 1993;168:1589-92.

306. Bell DM. *Human immunodeficiency virus transmission in health care settings: risk and risk reduction.* Am J Med 1991;91:S294-300.

307. CDC. *Update: human immunodeficiency virus infections in health care workers exposed to blood of infected patients.* MMWR 1987;36:285-89.

308. Spach DH, Silverstein FE, Stamm WE. *Transmission of infection by gastrointestinal endoscopy and bronchoscopy.* Ann Intern Med 1993;118:117-28.

309. Cryan EMJ, Falkiner FR, Mulvihill TE et al. ***Pseudomonas aeruginosa*** *cross-infection following endoscopic retrograde cholangiopancreatography.* J Hosp Infect 1984;5:371-76.

310. O'Connor BH, Bennett JR, Sutton DR et al. *Salmonellosis infection transmitted by fibreoptic endoscopes.* Lancet 1982:864-66.

311. Kaczmarek RG, Moore RM Jr, McCrohan J et al. *Multi-state investigation of the actual disinfection/sterilization of endoscopes in health care facilities.* Am J Med 1992;92:257-61.

312. CDC. *Case-control study of HIV seroconversion in health care workers after percutaneous exposure to HIV-infected blood — France, United Kingdom, and United States, January 1988-August 1994.* MMWR 1995;44:929-33.

313. Davis RM, Orenstein WA, Frank JA et al. *Transmission of measles in medical settings 1980 through 1984.* JAMA 1986;255:1295-98.

314. Sienko DG, Friedman C, McGee HB et al. *A measles outbreak at university medical settings involving health care providers.* Am J Public Health 1987;77:1222-24.

315. CDC. *Nosocomial transmission of multi-drug resistant tuberculosis among HIV infected persons — Florida and New York, 1988-1991.* MMWR 1991;40:585-91.

316. Malasky C, Jordan T, Potulski F et al. *Occupational tuberculous infections among pulmonary physicians in training.* Am Rev Respir Dis 1990;142:505-07.

317. Sepkowitz KA. *Occupationally acquired infections in health care workers.* Ann Intern Med 1996;125:826-34,917-28.

318. Atuk NO, Hunt EH. *Serial tuberculin testing and isoniazid therapy in general hospital employees.* JAMA 1971;218:1795-98.

319. Craven RB, Wenzel RP, Atuk NO. *Minimizing tuberculosis risk to hospital personnel and students exposed to unsuspected disease.* Ann Intern Med 1975;82:628-32.

320. Stover BH, Bratcher DF. *Varicella-zoster virus: infection, control, and prevention.* Am J Infect Control 1998;26:369-84.

321. Health Canada. *Canadian immunization guide*. Fifth edition, 1998.

322. Health and Welfare Canada. *Infection control guidelines for occupational health in health care facilities*. Ottawa, 1990 (under revision).

323. Menzies D, Fanning A, Yuan L et al. *Tuberculosis among health care workers.* N Engl J Med 1995;332:92-98.

324. Anderson MJ, Higgins PG, Davis LR et al. *Experimental parvovirus infection in humans.* J Infect Dis 1985;152:257-65.

325. Isaacs D, Dickson H, O'Callaghan C et al. *Handwashing and cohorting in prevention of hospital acquired infections with respiratory syncytial virus.* Arch Dis Child 1991;66:227-31.

326. Springthorpe S, Sattar SA. *Chemical disinfection of virus-contaminated surfaces.* Crit Rev Environ Control 1990;20:169-229.

327. Noskin GA, Stosor V, Cooper I et al. *Recovery of vancomycin-resistant enterococci on fingertips and environmental surfaces.* Infect Control Hosp Epidemiol 1995;16:577-81.

328. Struelens MJ, Maas A, Nonhoff C et al. *Control of nosocomial transmission of* ***Clostridium difficile*** *based on sporadic case surveillance.* Am J Med 1991;91(Suppl.3B):138S-44S.

329. Boyce JM. *Methicillin-resistant* ***Staphylococcus aureus****: a continuing infection control challenge.* Eur J Clin Microbiol Infect Dis 1994;13:45-49.

330. Boyce JM. *Vancomycin-resistant enterococci: pervasive and persistent pathogens.* Infect Control Hosp Epidemiol 1995;16:676-79.

331. Hartstein AI. *Improved understanding and control of nosocomial methicillin-resistant* ***Staphylococcus aureus****: are we overdoing it?* [editorial comment]. Infect Control Hosp Epidemiol 1995;16:257-59.

332. Sheretz RJ, Reagan DR, Hampton KD et al. *A cloud adult: the* ***Staphylococcus aureus*** *— virus interaction revisited.* Ann Intern Med 1996;124:539-47.

333. Dooley Jr SW, Castro KG, Hutton MD et al. *Guidelines for preventing the transmission of tuberculosis in health-care settings, with special focus on HIV-related issues.* MMWR 1990;39 (RR-17):1-29.

334. Gomolin IH, Leib HB, Arden NH et al. *Control of influenza outbreaks in the nursing home: guidelines for diagnosis and management.* J Am Geriatr Soc 1995;43:71-74.

335. Tamblyn SE. *Recognizing and controlling respiratory disease outbreaks in long-term care facilities.* Can Med Assoc J 1997;157:1257-58.

336. Duckworth G, Heathcock R. *Guidelines on the control of methicillin-resistant* ***Staphylococcus aureus*** *in the community. Report of a combined working party of the British Society for Antimicrobial Chemotherapy and the Hospital Infection Society.* J Hosp Infect 1995;31:1-12.

337. Strausbaugh L. *Antimicrobial resistance: problems, laments, hopes.* Am J Infect Control 1997;25:294-96.

338. Kolbe F, Jeans R, Duff Z et al. *Guidelines for management of vancomycin-resistant enterococcus.* Can Nurs Home 1996;7:5-8.

339. Cann D, Low DE, Blacklock A et al. *VRE: The next endemic?* Long Term Care (Ontario Nursing Home Association - Markham) 1996;6:10-12.

340. Anderson RL, Carr JH, Bond WW et al. *Susceptibility of vancomycin-resistant enterococci to environmental disinfectants.* Infect Control Hosp Epidemiol 1997;18:195-99.

341. Roth MK, Land GK. *How to prevent infection in a home care patient.* RN 1987:61-70.

342. Frénay HME, Vandenbroucke-Grauls CMJE, Molkenboer MJCH et al. *Long-term carriage, and transmission of methicillin-resistant* ***Staphylococcus aureus*** *after discharge from hospital.* J Hosp Infect 1992;22:207-15.

343. Weaver A. *MRSA and its management in the community.* Community Nurse 1996;October:36-38.

344. Health Canada. *Infection control guidelines for health care workers for Creutzfeldt-Jakob disease in Canada* (in progress).

345. Health and Welfare Canada. *Infection control guidelines part II. Prevention of surgical wound infections.* Ottawa, 1990:13-25.

346. Health and Welfare Canada. *Infection control guidelines part V. Hospital environmental control.* Ottawa, 1990:63-82.

347. Health Canada. *Evidence-based medicine.* CCDR 1994;20:145-56.

348. Health and Welfare Canada. *Future directions in continuing care. Report of the Federal/Provincial/Territorial Subcommittee on Continuing Care.* Ottawa, 1992.

349. Aznar J, Safi H, Romero J et al. *Nosocomial transmission of tuberculosis infection in pediatrics wards.* Pediatr Infect Dis J 1995;14:44-48.

Appendix I
Guideline Rating System

A. Previous rating system for statements

The Laboratory Centre for Disease Control (LCDC) Infection Control Guidelines previously used a system for rating guideline statements based on the strength of the evidence[345,346].

B. Current rating system for recommendations

A more elaborate system of rating was proposed for LCDC in 1994[347], with five categories to rank the strength of evidence *for* (categories A-C) or *against* (D-E) a statement, and three grades to describe the quality of supportive studies. The format uses an evidence-based medicine approach, which stresses the examination of evidence from clinical research, especially randomized studies, and places less emphasis on intuition and recalled experiences.

The new rating scheme, with one modification, is used in this document with appropriate clarification of evidence described in the text. The modification occurs in Category C with the word "insufficient" replacing "poor" in the original rating scheme. This system is outlined in Table 8.

TABLE 8. Strength and Quality of Evidence for Recommendations

Categories for strength of each recommendation	
CATEGORY	**DEFINITION**
A	Good evidence to support a recommendation for use.
B	Moderate evidence to support a recommendation for use.
C	Insufficient evidence to support a recommendation for or against use.
D	Moderate evidence to support a recommendation against use.
E	Good evidence to support a recommendation against use.
Categories for quality of evidence on which recommendations are made	
GRADE	**DEFINITION**
I	Evidence from at least one properly randomized, controlled trial.
II	Evidence from at least one well-designed clinical trial without randomization, from cohort or case-controlled analytic studies, preferably from more than one centre, from multiple time series, or from dramatic results in uncontrolled experiments.
III	Evidence from opinions of respected authorities on the basis of clinical experience, descriptive studies, or reports of expert committees.

Appendix II
Glossary of Terms

Acute Care Facility — A hospital where lengths of stay average < 30 days, and where a variety of services are provided, including surgery and intensive care.

Antimicrobial Agent — A product that kills or suppresses the growth of microorganisms.

Antimicrobial Resistant Organism — A microorganism that has developed resistance to the action of several antimicrobial agents and that is of special clinical or epidemiologic significance. Organisms included in this group are MRSA, VRE, penicillin-resistant pneumococcus, certain Gram negative bacilli resistant to all penicillins and cephalosporins, and multi-drug resistant *Mycobacterium tuberculosis*. Other microorganisms may be added to this list if antibiotic resistance is judged to be significant in a specific health care facility or patient population, at the discretion of the infection control program or local, regional or national authorities.

Antiseptic — A product with antimicrobial activity that is designed for use on skin or other superficial tissues; removes both transient and resident flora. The term is used for preparations applied to living tissue.

Barrier Techniques — Use of single rooms, gloves, masks, or gowns in health care settings to prevent transmission of microorganisms.

Carrier — An individual who is found to be persistently colonized (culture-positive) for a particular organism, at one or more body sites, but has no signs or symptoms of infection.

Cohort — Two or more patients colonized or infected with the same organism who are separated physically (e.g. in a separate room or ward) from other patients who are not colonized or infected with that organism.

Cohort Staffing	The practice of assigning specified personnel to care only for patients/residents known to be colonized or infected with the same organism. Such personnel would not participate in the care of patients/residents who are not colonized or infected with that organism[95,132].
Colonization	Presence of microorganisms in or on a host with growth and multiplication but without tissue invasion or cellular injury.
Communicable	Capable of being transmitted from one person to another; synonymous with "infectious" and "contagious".
Community-acquired infection	Infection acquired outside a health care setting.
Contamination	The presence of microorganisms on inanimate objects (e.g. clothing, surgical instruments) or microorganisms transported transiently on body surfaces such as hands, or in substances (e.g. water, food, milk).
Contagious	Capable of being transmitted from one person to another; synonymous with "infectious" and "communicable".
Disease	Clinical expression of infection; signs and/or symptoms are produced.
Immunocompromised	Increased susceptibility to infection. In this document the term refers to patients with congenital or acquired immunodeficiency or immunodeficiency due to chemotherapeutic agents or hematologic malignancies.
Infection	The entry and multiplication of an infectious agent in the tissues of the host (a) Inapparent (asymptomatic, subclinical) infection: an infectious process running a course similar to that of clinical disease but below the threshold of clinical symptoms (b) Apparent (symptomatic, clinical) infection: one resulting in clinical signs and symptoms (disease).
Infectious	Caused by infection or capable of being transmitted.
Infectious tuberculosis	Factors related to the patient that enhance transmission and determine the patient's level of infectivity include disease involving the lungs, airways or larynx

	presence of acid-fast bacilli on microscopic direct smear examination of the sputum presence of cavitation, extensive disease, or pneumonic infiltrates on x-ray undergoing a procedure that can induce coughing or cause aerosolization of tubercle bacilli presence of cough, sneeze or other forceful expiratory procedure in a patient with pulmonary TB[20].
Isolation	The physical separation of infected individuals from those uninfected for the period of communicability of a particular disease.
Long term care facility	Residential care that includes a variety of levels and types of care for clients who can no longer safely live at home (e.g. because of their need for medication supervision, 24-hour surveillance, assisted meal service, professional nursing care and/or supervision). Terminology varies provincially, e.g. nursing home, chronic care hospital, extended care unit[348].
Nosocomial infection	Infection acquired in a health care setting.
Outbreak	An excess over the expected incidence of disease within a geographic area during a specified time period, synonymous with epidemic.
Precautions	Interventions implemented to reduce the risk of transmission of microorganisms from patient to patient, patient to health care worker, and health care worker to patient.

Appendix III
Techniques

A. Terminal cleaning

1. Upon discharge of a patient, the room, cubicle or bedspace, bed, bedside equipment and environmental surfaces should be thoroughly cleaned before another patient is admitted.

    a. Terminal cleaning should primarily be directed toward those items that have been in direct contact with the patient or in contact with the patient's excretions, secretions, blood or body fluids.

    b. Housekeeping personnel should use the same precautions to protect themselves during terminal cleaning that they would use for routine cleaning. Masks are not needed unless the room was occupied by a patient for whom there were airborne precautions and insufficient time has elapsed to allow clearing of the air of potential airborne organisms.

    c. All disposable items should be discarded.

    d. Reusable items that have been in direct contact with the patient or with the patient's excretions, secretions, blood or body fluids should be reprocessed as appropriate to the item. Refer to *Infection Control Guidelines: Hand Washing, Cleaning, Disinfection and Sterilization in Health Care* for reprocessing recommendations[232].

    e. Bedside tables, bed rails, commodes, mattress covers, and all horizontal surfaces in the room should be cleaned. Refer to *Infection Control Guidelines: Hand Washing, Cleaning, Disinfection and Sterilization in Health Care* for recommendations regarding housekeeping. The recommendations include: "A detergent is acceptable for surface cleaning in most areas. A low or intermediate grade disinfectant, often called a germicidal detergent, may be preferable for cleaning in nurseries, pediatric settings, critical care, burn units, emergency rooms, operating rooms, bone marrow transplantation facilities, and surfaces of dialysis machines"[232].

    f. Carpets that are visibly soiled with patient's excretions, secretions, blood or body fluids should be shampooed.

g. Routine washing of walls, blinds, and curtains is not indicated. These should be cleaned if visibly soiled.

h. Cubicle curtains should be changed.

i. Disinfectant fogging is not a satisfactory method of decontaminating air and surfaces and should not be used.

2. In general no special cleaning techniques are required for rooms that have housed patients for whom additional precautions were in place.

   a. Special terminal cleaning procedures may be indicated for certain organisms, e.g. *Clostridium difficile* or VRE, in outbreaks. In such cases, thorough cleaning and disinfection with a disinfectant known to be effective against the organism in question should be performed. Attention should be paid to frequently touched surfaces such as doorknobs, call bell pulls, faucet handles, and wall surfaces which have been frequently touched by the patient.

   b. Local public health authorities or the medical officer of health and LCDC should be consulted about cleaning the room of a patient who has Lassa, Ebola, Marburg or other viral hemorrhagic fevers.

B. Gown use

When using gowns, the following points should be observed:

Gowns should be located conveniently.

Hands must be washed before gowning.

The gown must be long enough to cover the clothes, and the sleeves must be no shorter than just above the wrist.

The gown is put on with the opening at the back, with edges overlapping, thus covering as much clothing as possible.

The gown is tied at the waist and neck.

The neck and waist ties are undone and the gown removed without touching the clothing, then turned inside on itself, rolled up and placed in laundry hamper.

Hands are washed.

Gowns are preferably used only once. For routine patient care, if a gown is used more than once, it should be used for a single patient only, and discarded if wet, soiled, or at the end of the health care worker's shift.

Wet gowns must be removed immediately to prevent a wicking action that facilitates the passage of microorganisms through the fabric.

C. Masks

In general, masks are recommended to prevent transmission of infectious agents through the air.

Masks protect the wearer from inhaling

small particle aerosols (droplet nuclei) that remain suspended in the air and thus travel long distances. Special high efficiency dust/mist masks are used for this kind of protection. These must fit well to provide a tight facial shield. The health care worker should be fitted with a mask and educated regarding the proper way to wear it to obtain a tight facial shield[20]. Special high efficiency dust/mist masks may be used for a maximum period of time as stated by the manufacturer. These should be changed earlier if wet or soiled.

large particles (droplets) that are transmitted by close contact and generally travel only short distances (about one metre). Surgical/procedure masks are used for this kind of protection.

Masks might also prevent acquisition of some infections that are spread by direct contact with mucous membranes because masks may prevent personnel from touching the mucous membranes of their eyes, nose, and mouth until after they have washed their hands and removed the mask.

If the infection is transmitted by large particle droplets, masks are recommended only for those close to the patient. If the infection is transmitted over longer distances by small particle aerosols, masks are recommended for all persons entering the room.

When using a surgical/procedure mask the following should be borne in mind:

Masks should be used only once and changed if wet (because masks become ineffective when moist).

Masks should cover both the nose and the mouth.

Avoid touching the mask while it is being worn.

Discard all masks into an appropriate receptacle.

Masks must not be allowed to dangle around the neck.

Wash hands after removing the mask.

D. Hand washing and gloves

For further information and recommendations on hand washing and glove use, refer to Health Canada *Infection Control Guidelines: Hand Washing, Cleaning, Disinfection, and Sterilization in Health Care*[232] and *Preventing the Transmission of Bloodborne Pathogens in Health Care and Public Services Settings*[21].